

16c9 ✓

# RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

---

Owned and Published by  
**THE RADIOLOGICAL SOCIETY**  
OF NORTH AMERICA  
*As its Official Journal*

---

LIBRARY  
DEC 31 1928  
DARTMOUTH COLLEGE



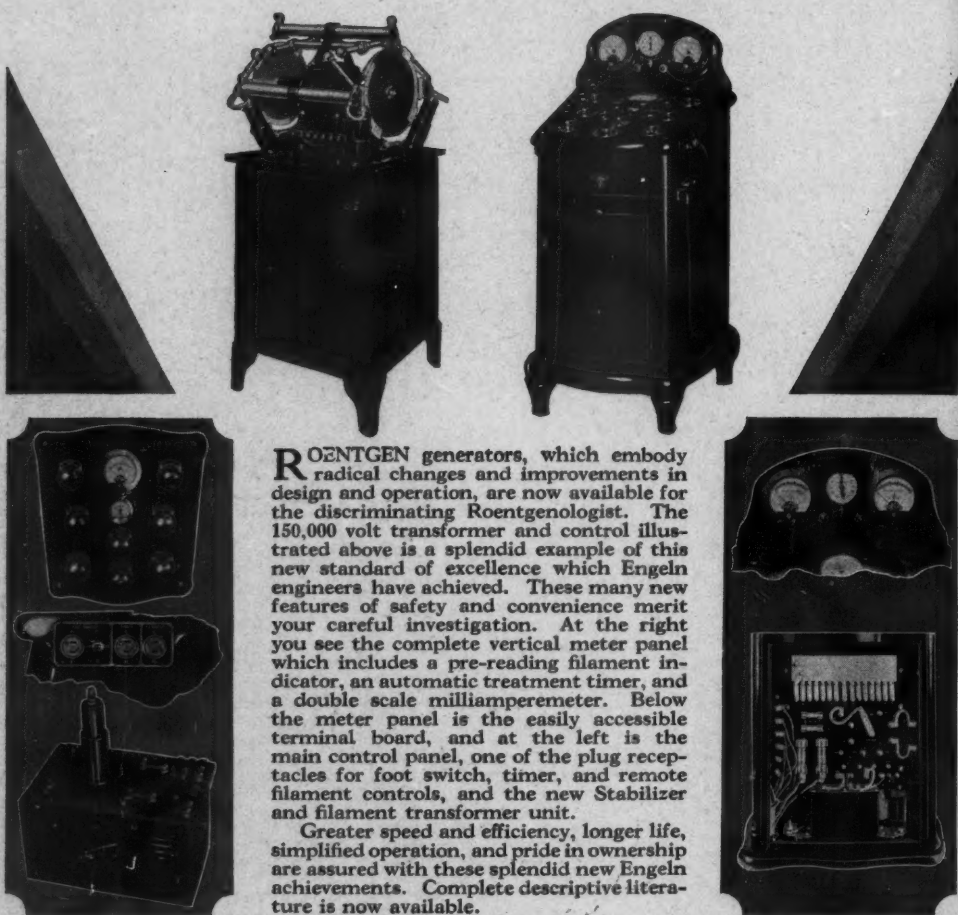
JANUARY, 1929

Volume XII

Number 1



## *A New Standard of Excellence*



**R**OENTGEN generators, which embody radical changes and improvements in design and operation, are now available for the discriminating Roentgenologist. The 150,000 volt transformer and control illustrated above is a splendid example of this new standard of excellence which Engeln engineers have achieved. These many new features of safety and convenience merit your careful investigation. At the right you see the complete vertical meter panel which includes a pre-reading filament indicator, an automatic treatment timer, and a double scale milliamperemeter. Below the meter panel is the easily accessible terminal board, and at the left is the main control panel, one of the plug receptacles for foot switch, timer, and remote filament controls, and the new Stabilizer and filament transformer unit.

Greater speed and efficiency, longer life, simplified operation, and pride in ownership are assured with these splendid new Engeln achievements. Complete descriptive literature is now available.

### THE ENGELN ELECTRIC COMPANY

2750 Superior Ave., Cleveland, Ohio

PHYSIOTHERAPY  
X-RAY  
EQUIPMENT

DEC 13 1929

257457

B.P.

61257

97118

V.12







# RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

VOL. XII

JANUARY, 1929

No. 1

## LIPIODOL IN ITS RELATION TO CHEST DIAGNOSIS<sup>1</sup>

By B. H. NICHOLS, M.D., Cleveland Clinic, CLEVELAND, OHIO

THE use of lipiodol in the demonstration of lesions in the respiratory tract is one of the outstanding contributions to diagnostic medicine. Recent literature is full of reports from men who are employing this method, and the mass of evidence already accumulated is of the utmost value to the future usefulness of bronchography. The first visualization of the bronchial tree by lipiodol was done by Sicard and Forestier in 1922.

As the method of choice for the introduction of lipiodol into the respiratory tract is still *sub judice*, it may be well to mention here some of the different methods which have been suggested.

1. Through the cricothyroid membrane by syringe.
2. Through the trachea, below the isthmus of the thyroid gland.
3. The bronchoscopic route.
4. The translottic route, by means of the laryngeal syringe.
5. The laryngeal and tracheal route, by means of a catheter, which may be passed to any desired point in the right or left bronchus.

A review of the literature shows that writers for the most part have employed only one method of injection. Although this may have the advantage that the operator becomes highly efficient in his use of

a single method, nevertheless it does not appear to us to be the most ideal plan, as there may be many advantages in the selection of the method most desirable for each individual case. The comments of Mosher (1) appear to be in accordance with this conclusion. He says that "so many apparent lung abscesses have been found in the cases referred from the Thoracic Service of the Massachusetts General Hospital to the Throat Department for diagnostic bronchoscopy and the injection of lipiodol, that the suspicion has been growing that the shadow which so perfectly simulated an abscess, in most cases, was an area of 'drowned lung,' that is, drowned in lipiodol." To prove this he made extensive experiments on the lungs of dogs, which he thought proved that "40 per cent lipiodol injected into the terminal bronchus of a normal lung will give a picture of lung abscess. In order not to draw false conclusions, therefore, weaker solutions of lipiodol must be used." It is our own impression, however, that the quantity rather than the strength of the solution is the important factor in producing these misleading pictures.

The catheter method of injection has been our method of choice for the demonstration of pulmonary lesions in many selected cases. The patient is referred to the Nose and Throat Department, where, after local anesthetization, the catheter is passed into the trachea. The patient is instructed

<sup>1</sup>Read before the Radiological Society of North America, at the Thirteenth Annual Meeting, at New Orleans, Nov. 28-Dec. 2, 1927.

to grasp the catheter between the teeth, and is then taken to the X-ray Department. If previous examination of the chest has shown the lesion to be located in the lower lobe of either lung, the patient is placed before the fluoroscope with the body tilted toward the side in which the injection is to be made. The catheter is filled with lipiodol under the fluoroscope and is introduced into the right or left bronchus, as is desired. The lipiodol is then injected slowly under observation until the periphery of the lung is reached or the desired area is outlined, when the injection is immediately discontinued and X-ray films are made.

If the lesion is in one of the upper lobes of the lung, the patient lies on the affected side, with his head lowered. It is thus possible to introduce the lipiodol without difficulty into a single upper lobe of the lung.

We feel that this method of introduction has a great many advantages, as usually only a small amount of lipiodol is necessary, and confusing shadows are eliminated by the avoidance of the overfilling of any portion of the lung. The method is particularly applicable for the study of bronchiectatic areas and also for the differentiation of tumor masses in the lung tissue or in a bronchus from those in the pleural cavity.

After a patient has been subjected to examination by this method it should be borne in mind that iodized oil is absorbed by the hilus glands, so that in subsequent examination of the chest by plain films the shadows of these glands may not be interpreted as being due to calcific infiltration.

For the observation of patients with lung abscesses we feel that the bronchoscopic method is best, as we believe it to be quite essential that the abscess cavity be aspirated before the oil is introduced, which can usually be done through the bronchoscope. Moreover, in addition to the aspiration of

the abscess cavity a foreign body may sometimes be seen to be the primary factor in the production of a lung abscess, a finding which is usually not made when lipiodol is injected by any other method.

Also in cases of non-tuberculous lesions of the chest in which there have been hemorrhages from the lung, bronchoscopy should be employed before ordinary oil injections are made. By means of the bronchoscope, specimens of granulation tissue or of a malignant lesion of the bronchus may be taken for pathologic examination, thus making possible a positive diagnosis which could not be secured by the injection of lipiodol alone.

In children, injection through the cricothyroid membrane is quite practical. However, bronchoscopy in children is not a difficult procedure, and should often be preferred.

Armand-Delille and Gelston (2) have called attention to the possible therapeutic value of the injection of iodized oil in cases of bronchial dilatation in children. The following quotation is from their report:

"Aside from the great diagnostic interest presented by this method of intratracheal injections of iodized oil in children, emphasis should be placed on the fact that it is entirely innocuous and further holds out the hope of perhaps having a therapeutic application of some considerable value. In fact, we have observed in a number of young patients a marked lessening in cough and expectoration, together with modification of physical signs indicating a diminution in the size of the bronchial cavities. It would appear that there might be a local effect of the iodine. So far, we have not checked this by means of second injections."

In the case of a lesion which is confined to the hilus of the lung, we feel that the insufflation of bismuth subcarbonate as originated by Jackson and described by Tucker (3) is the most desirable method of examination, the procedure being always pre-

ceded by bronchoscopy. By this method the cavities and the bronchi are well outlined and overlying and confusing shadows are avoided.

Most writers agree that lipiodol injections should not be made in cases of pulmonary tuberculosis. We feel, also, that in the presence of the following conditions the injection of lipiodol is contra-indicated.

1. *In the presence of hyperthyroidism*, even if only the mildest toxic symptoms are manifested, lipiodol should be given cautiously. It should first be ascertained whether or not the patient has received Lugol's solution or other iodine preparations prior to examination of the chest. It has been demonstrated conclusively that during the first forty-eight hours after the injection of lipiodol, iodine is eliminated in quite large quantities, and that thereafter it is eliminated more slowly but in sufficient quantity for iodine to be found in the urine for a considerable period of time. According to Forestier (cited by Archibald and Brown, 4), "after an intratracheal injection of 20 c.c. of lipiodol, the daily elimination of iodine during the first two weeks is about 0.02 gm." This retained iodine may be quite sufficient to produce a marked exacerbation of hyperthyroidism.

In an address before the German Association of Internists, in 1925, Ludolph Brauer (5) reported three cases in which iodism resulted from the injection of lipiodol into the lung.

All agree on oil in the gastro-intestinal tract.

There has been considerable controversy between the French and the German schools as to whether or not fats are absorbed in the lung; the Germans do not believe that the absorption of fat is accomplished in the lung tissue, but feel that the danger lies in the possibility of absorption of the iodized oil in the digestive tract. For this reason they urge that great care should be taken

to avoid the entrance of lipiodol into the alimentary canal during the injection, in any patient in whom an idiosyncrasy for iodine is suspected.

2. *In the presence of advanced cardiac disease* any manipulation of the respiratory tract or the introduction of a substance which embarrasses the respiration is contra-indicated.

3. *In the presence of any marked elevation of temperature* lipiodol injection should be employed with extreme caution.

As indicated above, we agree that the presence of pulmonary tuberculosis is usually a contra-indication to lipiodol injection. It has been proved conclusively by a number of clinicians that hemoptysis and the appearance of tubercle bacilli in the sputum have followed the use of lipiodol in cases in which, before the injection, there had been no such symptoms. On the other hand, when it is important to outline a cavity in an old case of tuberculosis in which considerable fibrosis has taken place, the use of lipiodol is probably accompanied by but little danger. Generally, however, the greatest caution should be used in employing this measure in any case in which this disease is present.

That the supraglottic route should be employed in cases of tuberculosis is indicated by Archibald (6), who says:

"A simpler method of injection than the bronchoscopic probably is best, because, no matter how carefully and skillfully this procedure is carried out, it taxes the patient's strength more than a simple supraglottic injection."

The greatest value of pulmonary lipiodol injection is in the diagnosis of bronchiectasis and lung abscess. It also aids in the determination of the exact size and location of an abscess cavity, thus helping to indicate the plan of treatment which should be undertaken. However, it should be borne in mind that, since only a small tract leads to

the cavity in tuberculosis, it may be difficult to fill it. Archibald cites the value of the injection of iodized oil during the progress of a multiple stage operation for bronchiectasis or abscess of the lung, in order that the extent and location of the disease that still remains may be estimated.

Lipiodol injection has also been of extreme value in the differentiation of lesions in the pleural cavity from lesions of the lung tissue, such as tumor and pneumonitis.

The outline of the trachea after the injection of iodized oil may aid in the definition of a mediastinal tumor or aneurysm, as the extent and location of compression or displacement of the trachea may be clearly shown.

It is of much help in cases of pulmonary fistula, as in the past some very unpleasant experiences have followed the injection of bismuth and oil into a pulmonary fistula, for if the fistula leads directly into the lung, the entire bronchial tree may become filled—with unpleasant results. When lipiodol is used, however, whether the fistula leads only to the pleural cavity or into the lung itself, no uncomfortable symptoms follow the injection and much valuable information may be obtained. In these cases the injection should be made under fluoroscopic control, as often the first impression, when only a small amount of oil has been injected into the lung, together with the accurate delineation of the course of the injection, gives much more help in the diagnosis than a film made after a considerable quantity of the lipiodol has been introduced.

#### CONCLUSIONS

1. In making a lipiodol injection, the method of choice is the one indicated in the individual case.

2. The catheter method of injection under fluoroscopic observation is the most accurate and simple in a large percentage of cases.

3. In cases of hemorrhage without tuberculosis the bronchoscopic method is to be preferred, as a specimen may be obtained for microscopic study.

4. Lesions at the hilus, where the bronchi are large and many confusing shadows are present, may best be injected by the insufflation method of Jackson.

5. The transglottic route is the most desirable in dealing with advanced cardiac lesions.

6. The danger of over-filling the lung, with the resultant difficulty in diagnosis, should be borne in mind.

7. Injection through the cricothyroid membrane is the most desirable method in children.

8. Care should be taken to avoid the entrance of much lipiodol into the gastrointestinal tract.

9. The possibility that lipiodol is still present in the bronchial lymph glands should be borne in mind when subsequent examinations of the chest are made.

10. Lipiodol injections made between the various stages of a multiple stage operation for bronchiectasis and lung abscess may be of great aid in the determination of the extent of the lesions.

11. Outlining the trachea by the transglottic route is often of value for the determination of lesions in the mediastinum, such as tumor and aneurysm.

12. The most important contra-indications to lipiodol injection are hyperthyroidism or an idiopathic susceptibility to iodine, advanced cardiac lesions, pulmonary tuberculosis (in most cases), and a marked elevation of temperature. The use of lipiodol, however, as a rule rarely produces any serious consequences, but we should be ever conscious of a definite degree of danger and patients should not be submitted to this procedure indiscriminately.

#### REFERENCES

- (1) MOSHER, H. P.: False lung abscess and lipiodol. *Laryngoscope*, 1927, XXXVII, 138.



- (2) ARMAND-DELILLE, P., and GELSTON, C. F.: The diagnosis of dilatation of the bronchi in children by means of the injection of iodized oil. *Am. Jour. Dis. Child.*, 1924, XXVIII, 527-548.
- (3) TUCKER, G.: Technic of bronchoscopic introduction of bismuth subcarbonate and iodized oil, 40 per cent, for pneumonography. *Arch. Surg.*, 1927, XIV, 175-183.
- (4) ARCHIBALD, E., and BROWN, A. L.: Dangers of introducing iodized oil into the tracheo-bronchial system. *Jour. Am. Med. Assn.*, 1927, LXXXVIII, 1310-1315.
- (5) BRAUER, L.: Ueber Pathologie und Therapie der Bronchietasien. *Deutsche med. Wchnschr.*, 1925, LI, 886.
- (6) ARCHIBALD, E. W.: Value of iodized oil, 40 per cent, in the diagnosis of pulmonary infections. *Arch. Surg.*, 1927, XIV, 206-210.

**A New Method to Increase the Value of Cholecystography for Differential Diagnosis.** Arnold Grebe. *München. Med. Wchnschr.*, November, 1927, LXXIV, Nr. 47, p. 2016.

From previous experimentation the author concluded that value for differential diagnosis could be placed only upon a response in the form of a clear, perfect picture of the gall bladder. The negative response to one of the contrast media, in his opinion, must be disregarded unless particular precautions are taken. He realizes that with such a statement he will be out of agreement with most authors. In his opinion, a normal response to tetraiodophenolphthalein is often prohibited by reflex response to other irritations, especially of the gastro-intestinal tract. Therefore, he has tried to eliminate such reflexes and administers to the patient 1.25 milligram of

atropine plus 0.01 Holopon-atropine; three hours later 0.01 morphine. With such anti-spasmodic measures he has succeeded in obtaining entirely normal cholecystographic responses in a considerable series of cases which, at a first attempt, without anti-spasmodic, failed to produce a normal gall-bladder shadow. The experiment proves, roentgenologically, on the living being, the close interrelationship of the intra-abdominal organs, a fact which often makes differential diagnosis difficult. It also demonstrates that the use of all substances which are antagonistic to atropine, especially hypophysin, is contra-indicated. It would seem advisable to repeat these experiments on a large number of cases which at first attempt do not respond normally to the administration of one of the cholecystographic contrast media.

HANS A. JARRE, M.D.

## DIAGNOSTIC USES OF LIPIODOL IN THE PARANASAL SINUSES<sup>1</sup>

By ROBERT H. FRASER, A.B., M.D., F.A.C.S., BATTLE CREEK, MICHIGAN

From the Departments of Otolaryngology and Roentgenology, Battle Creek Sanitarium.

THE paranasal sinuses are presenting an increasingly insistent challenge to the roentgen ray as the only accurate visual method for their direct study. It has been called upon to round out not only its own findings, but also those of the rhinologist and the internist, toward a complete diagnosis. The roentgenogram is no longer thanked for duplicating information which is obtainable more simply by rhinoscopy, but may even be on the defensive for any deficiencies in the diagnostic picture. The internist, with his pet focal infection symptoms to explain, and the rhinologist, with a long list of therapeutic procedures awaiting application, want to know very much both positively and negatively about every sinus. Even the patient, with a modern desire for both physical and psychological satisfaction, proves a further incentive toward thorough graphic findings.

The significance of the roentgenogram lies in its anatomical points, lines, and densities, many of the most useful of which are very well shown in the ordinary examination, the primary roentgenogram. We find limiting lines in the maxillary sinus and in the bones of the cranium, and can distinguish opaque foreign bodies, osseous changes, and often obliteration of the air cavity. Soft tissues, however, which arise in the sign of "tumor" in inflammatory diseases, are fugitive witnesses, whose evidence will not be taken as on oath by the conscientious surgeon. For their detection opaque injection materials are now used consistently in suitable cases, and iodized oil (8, 31) has displaced the earlier solutions and suspensions, which were more difficult to admit into the sinuses and required sub-

sequent removal (3, 16, 34). It has been used as a test of patency and other characteristics of the course of all the extensions of the upper respiratory air space—eustachian tube, lachrymal tract, fistulae, and salivary ducts; but the needs for it in inflammations of the paranasal sinuses and the complexity of its use there outrank all the others and may well occupy our full attention here.

Since the density of lipiodol is more than ample for sinus use, it is diluted with paraffins or olive oil and the resulting iodized oil, unless otherwise mentioned, will be understood as of 14 per cent iodine content. It is assumed that a primary roentgenogram in each of the usual positions, of which we use Caldwell, Waters, MacFarlan, lateral, and Granger—five films—should be made before treating the sinus directly in any way. For evaluation of comparative results, experience is still too recent to attempt a statistical survey. The aim will, therefore, be to confine ourselves to the description of some methods which we employ and to the pointing out of such principles, practices, and conclusions as we believe are not self-evident but will contribute to the success of such work.

There are two main methods of introducing the oil, namely, direct injection, as in neurologic and pelvic uses, and suffusion, which parallels the spread of the oil in the bronchi. Injection, following irrigation for discharge, deserves the emphasis because it is used most frequently, being most useful for the diseased maxillary sinus. The latter is not only the commonest rhinologic problem but the one in which pathologic anatomy has the greatest significance. The antrum, unlike the sphenoidal sinus, is never operated upon radically unless there is a

<sup>1</sup>Read by invitation before the Radiological Society of North America, at the Thirteenth Annual Meeting at New Orleans, Nov. 28-Dec. 2, 1927.

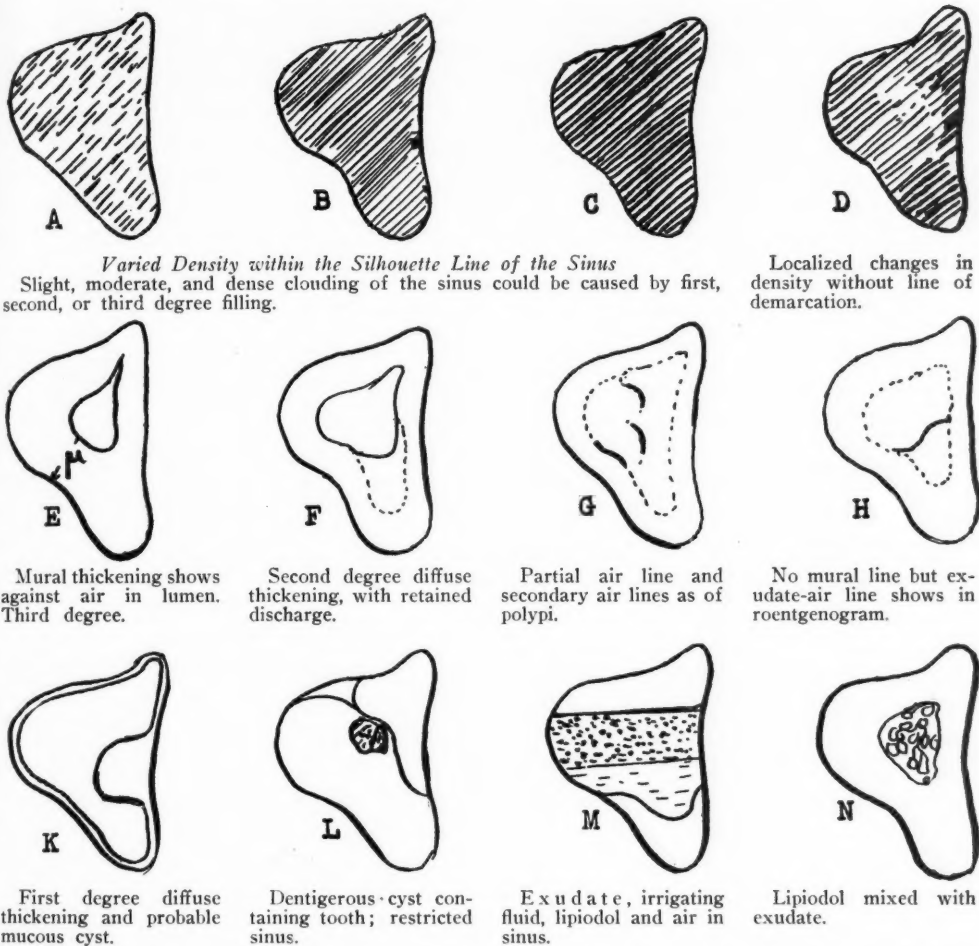


Fig. 1. Relationships occurring in sinus pathology. A-H, appearance in primary roentgenogram, indications for further study. K, L, conditions usually requiring opaque injection for diagnosis. M, N, conditions resulting from unsuccessful technic in injection.

filling defect. In the complete radical operation, also, the soft tissues are all removed, a procedure which is never done for the sphenoid. Because it admits of complete filling, the injection method gives full information with the minimum number of exposures, which conform to a routine for nearly all cases. The displacement irrigation or suffusion method requires greater descriptive space because it constitutes a more extensive procedure, if one proposes to obtain complete information of the thickenings within several sinuses. Requiring

more films, the technic and interpretation involve more physical principles and rules. These have not been sufficiently dealt with in the literature. The technic of displacement irrigation (suffusion) is subject to considerable modification, according to the needs of the case. There are, for example, normal and pathologic variations in the anatomy of the parts which the other diagnostic methods, in turn, vary in their ability to reveal. Nevertheless, the majority of cases, just as for injection, are amenable to one routine procedure.

TECHNIC FOR PARANASAL SINUS INJECTION:  
MAXILLARY

The commonest indications for injection are in chronic suppuration—dense X-ray shadow, pus in sinus and in nose—when

tight to the needle, and the sinus is filled. During the filling the head should be inclined towards the affected side at an angle of 45 degrees, so as to displace all air out the top (natural ostium) and avoid oil pressure by gravity on the fine puncture point

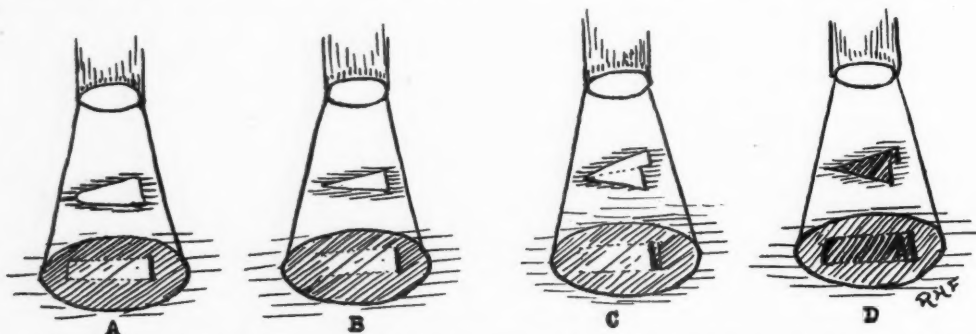


Fig. 2. Roentgenograms of cavities—their densities and production of lines. A, Borders of bony cavities are rounded; tangential rays give a line. B, thin wedges occur in diseased swellings; line only at base. C, a shape as of apposed wedges gives double line when air-containing. D, the same cavity with lipiodol shows three lines, the outer more distinct.

choice of treatment presents difficulty, and again in latent chronic hyperplastic sinus disease, with or without slight clouding on the X-ray film, when the sinus may be found normal or have more or less localized polypoid thickening. The latter, when found, often requires extirpation for constitutional effects. Both these situations present entirely practical problems, which were solved formerly only by the trial-and-error method.

Two drams of lipiodol are diluted to six drams by the addition of four drams of liquid petrolatum in a measuring glass. The sinus is irrigated by any method, cocaine-epinephrin having been applied to the point of entrance (Fig. 6). We use an applicator of cocaine-epinephrin in the inferior meatus for fifteen minutes, a straight Size 16 Lichtwitz needle, 6.5 cm. in length of shaft (12), and a 3-oz. bulb syringe, which is connected by 3 inches of rubber tubing. The normal saline is evacuated by air, following slowly without pressure, the head held strongly inclined on the opposite side. A record syringe is filled with the iodized oil, made

when the needle is withdrawn. The volume required before outflow to anterior and posterior nares is read, and about 2 c.c. additional is used while the head is rocked on its sagittal axis to dislodge any bubbles of air from the ethmoidal region at the roof of the sinus. Large puncture trochars are unnecessary and result in loss of oil with the resultant disadvantages of incomplete fillings. The head is kept in a lateral position until the conclusion of the X-ray examination, a precaution which does not interfere with a walk of some distance to the X-ray table. The writer's equipment consists of a set of instruments—syringes, needles and cannulae for natural ostia—which embody features for balance, delicacy of movement and pressure connections. No effort is made to evacuate the oil after the examination unless the patient is sensitive to iodine, in which case it is better to have used brominized oil.

The films made are four in number, including lateral-Waters (Fig. 20), lateral-lateral (stereo), and erect-lateral (Fig. 16).



The first adjective denotes the attitude of the head (decubitus) and the second the direction of the ray relative to the head, *i.e.*, horizontal, except in the stereo. The purpose of the latter position, which is one of

negligible. With a diluted oil valuable information may be obtained through the body of the filling, as in Figure 5-B. Before the advent of lipiodol, the workers, of whom Weil stood alone for many years,

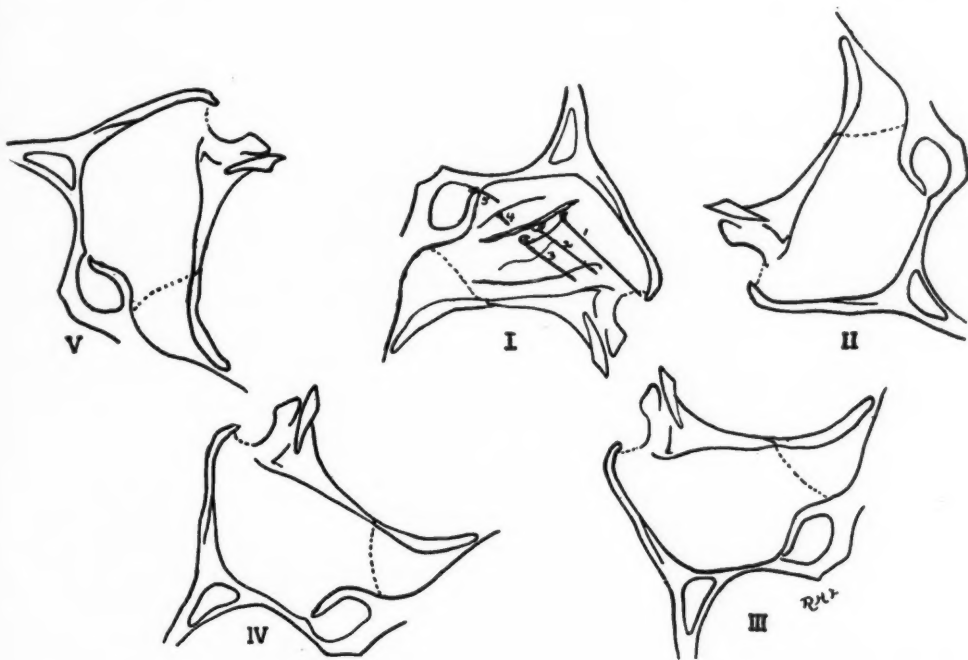


Fig. 3. The left nasal fossa, showing its use as a reservoir for suffusing the sinuses. I, erect position (unsuitable). II, prone position for frontal sinus, etc. III, inverted position, for all sinuses. IV, spheno-ethmoidal position for displacement of posterior series. V, supine position (not practicable).

convenience, is to pick out the bony wall line (Fig. 16-A), against which the measurement of the iodized oil line, *B*, is to be made, showing how far the oil filling should extend in a normal state. The illustration, Figure 1, shows a number of conditions which may obtain.

The ray falling as a tangent to the rounded cavity is depended on for most opaque injection findings. What rays pierce the body of the sinus and contribute only to a density show little, especially if full-strength lipiodol is used. The handicap of the primary roentgenogram is shown in Figure 2-B, in which, at the left, tangent rays are

used the greatest densities they could secure. Weil, working with Kienböck, made complete fillings with proper head positions—two principles which were ignored until recently (9).

We have not had the experience of disturbance of blood remaining in the sinus, or of wash-water, which escapes fully when displaced by air with the outlet lowermost. In advanced hyperplastic cases a part of the discharge may resist irrigation through the small needle or cannula. Such thick discharge, when suspected, should be approached by a 3 mm. opening, as made by the Thorwald antrum drill, and the applica-

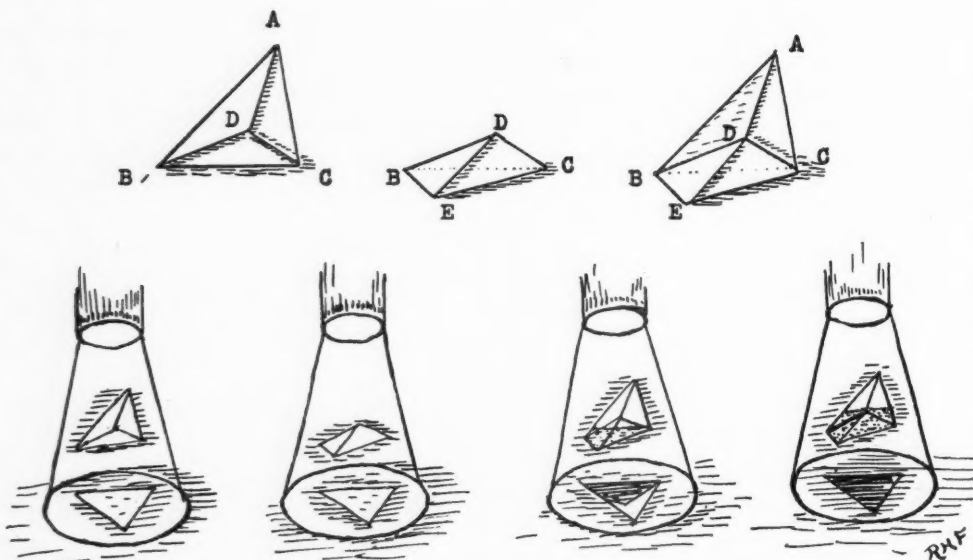


Fig. 4. Definite information from vertical tube position for partially filled sinus. The same shadow is cast by the two tetrahedral components of the hexahedron representing the sinus. The lipiodol level must reach the highest point of the girdle line BCD to give full contours.

tion of suction *via* a 2 mm. cannula. For thorough irrigation we favor the inferior meatus route.

#### INDIRECT METHODS FOR THE INTRODUCTION OF LIPIODOL

The employment of the nasal fossa as a reservoir or basin from which to fill the sinuses by gravity requires more or less inverted positions of the patient's head (Fig. 3). Each nasal fossa normally holds about 10 c.c., which will at once begin to enter any large opening, such as post-operative ostia, or the accessory ostium of the maxillary sinus. This movement is promoted by the pressure variations in the nose in ordinary respiration. In order to obtain a filling in a reasonable time and to permeate the small natural ostia with such regularity that failure to fill is indicative of obstruction and disease, the air must be rapidly displaced. The excellent pioneer publications of Proetz and Ernst upon displacement irrigation for the purpose of sinus mapping are well

known. The writer, at the time of those publications, was using self-induced pressure changes performed by the patient, and certain positions of the head. We were calling the oil movement a "suffusion"—flooding by gravity (Lat. sub. *fundere*)—in correspondence with the term "opaque injection" for the direct method, because these terms proved most convenient in our records.

Occasionally the soft palate will not become fixed against the posterior pharyngeal wall when repeated suction is applied to the closed nostrils, as in the Proetz technic (6 in. Hg., twelve times repeated). In that case the patient may use his own thoracic muscles and exert pressure and suction from the chest with the nostrils closed. Proetz' syringe for the proper application of suction gives the optimum results. His supine (actually supine plus 45 degrees) or sphenoethmoid position (Fig. 3, IV) fills the posterior series of sinuses of both sides, if the 5 c.c. of oil is replenished between courses of suction. The frontal sinus may fill if oil

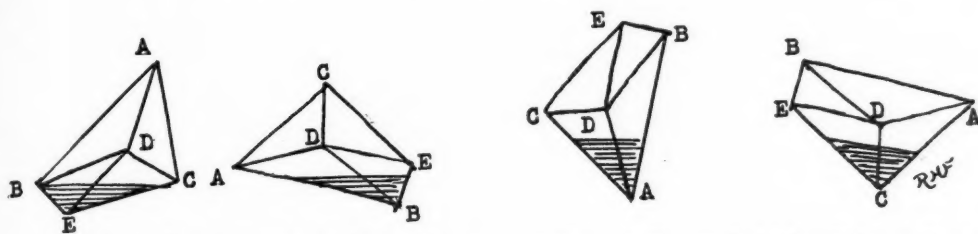


Fig. 5-A. Sinus incompletely filled with opaque medium. Rolling method of outlining walls consecutively. Horizontal direction of radiation.

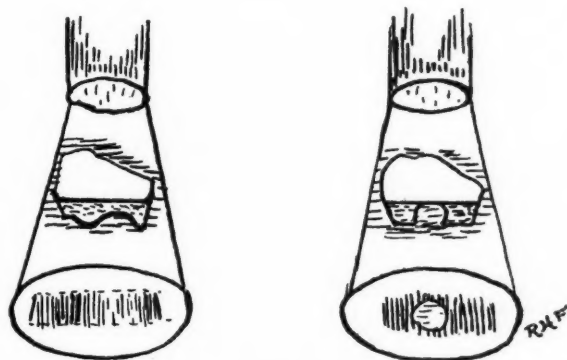


Fig. 5-B. Partially filled paranasal sinus capable of vertical radiation. Positions producing a "shallow spread" of oil: (a) an S-shaped undulation; (b) a localized mass revealed.

falls lateral to the middle turbinate or if capillarity holds some oil above the general level and to the required height. The writer's posterior position, called the "inverted position," meets the requirement of unilateral filling without blurring in lateral views. It increases the capacity of the nose to 10 c.c. and renders the frontal sinus dependent in position. The Proetz position, sphenoid-ethmoid, is comfortable for the patient. The inverted position, with its increase of 30 degrees extension, is disagreeable unless the body is inclined on a slant-board, which raises the hips 25 degrees. For the less robust individual the frontal sinus is best filled in the prone position.

The prone position, which favors the anterior series and affords strictly unilateral fillings, is aided by a piece of apparatus in which tunneled olives engage both nostrils

and lead by curving metal tubes up along (therefore beneath, in this position) the forehead to the oil and suction syringes, respectively. These syringes lie on the table above (beyond) the patient's head, making the filling and displacement very simple to execute. The writer's prone position is really prone plus 30 degrees, and holds oil as high as the sphenoidal ostium.

Suffusion is advisable for ethmoid, frontal, and sphenoid, and for maxillary sinuses in cases not warranting—from meagerness of suspicion or symptoms—the injection treatment. It is adapted to less advanced changes, especially to the determination of the normal neighbors of diseased sinuses, when the latter are obviously condemned to radical operation (Cases 172 and 174 below). In all its indications this method also fulfills our requirement of providing neces-





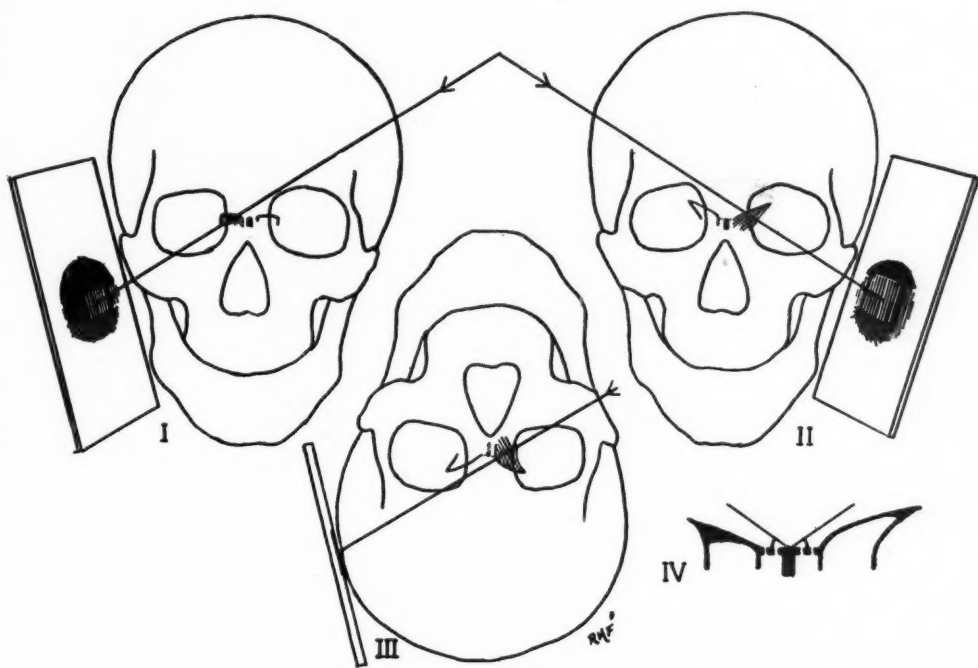


Fig. 7. Thirty-five degree inclined position of radiation for spacing out parts of opposite ethmoids (sphenoids). I, erect-inclined. II, showing supra-orbital extensions, left. III, inverted-inclined, for right. IV, thirty-five degree angle rays grazing cribriform and one ethmoid.

outlet. We have managed, therefore, to make the filling on the X-ray table.

The free surface of the oil in a partially filled sinus is approximately horizontal, but is somewhat influenced by adhesion and capillarity. Accordingly, any lines made by this surface upon the film must be disregarded. To this end, films are usually made by horizontal projection of the rays. One must outline a sufficient number of successive strips of dependent sinus wall to permit discovery of small local thickenings, and this requires several changes of position of the head (and contained oil). (See Fig. 5.) Mindful of the ease of study and the great aid derived in filling the maxillary by injection, one may try for nearly complete fillings by suffusion. Figure 6 shows the possibility of gaining full information from an incomplete filling, if the rays (vertical) avoid the small unfilled portion (properly superimposed).

The following principles may be listed for roentgenography:

1. Large sinuses, completely filled, with ostium uppermost, are suitable for any direction of exposure. (Figs. 16, 18, 20, 21.) The head need not be moved. A stereo-lateral view avoids confusion about bone lines.
2. Radiation should be directed to show the lines of election for measuring diffuse thickening. (Figs. 16, 18, 20, 21.)
3. Small rim fillings are desirable for the floor of the sphenoids, to avoid superposition.
4. In the suffusion positions, there is considerable value in the roentgenograms taken before moving the head or evacuation of the nasal fossa. (Figs. 8, 12, 13, 14, 19.)
5. Horizontal radiation manifests the contours of a floor strip in each cell. The



Fig. 8. Case No. 193, Obs. No. 300. Suffusion in inverted position, oil still in nose. Horizontal radiation (lateral). Normal findings. A, surface of oil in nasopharynx. G, direction of gravity.



Fig. 9. Obs. No. 300 (cont'd). Lipiodol in right sinuses. Supine position.

whole interior may be studied in this way, with very incomplete fillings. (Fig. 5-A.)

6. Vertical radiation is useful when the floor of a cell approximates the horizontal. Depressions, bulgings, and masses appear in the density. (Fig. 5-B.)

7. Vertical radiation succeeds also whenever a partial filling rises above the silhouette-perimeter or girdle line. Side walls are then outlined. (Fig. 4.)

8. Directions of radiation parallel to intercellular partitions are very useful. (Fig. 14.)

9. Large polypi may show their free contours most fully in the primary roentgenogram (Drea, 7). (Figs. 2-C, 2-D (lipiodol masking some lines), Fig. 1-G.) Most cases require iodized oil for complete assurance of the presence of polypi.

#### THE LIAISON LINE BETWEEN THE CONTRIBUTION OF THE RHINOLOGIST AND THAT OF THE ROENTGENOLOGIST

Before mention of the routine positions for opaque suffusion films, the scope of the

roentgenologist's effort and the information he receives from the rhinologist about the case are of interest. In our own earlier work, Dr. Upson, roentgenologist, and his technician, Mr. C. J. Rosenberger, have divided responsibility with us as follows: The former was responsible for the primary roentgenogram, while we were responsible for the fillings, the positions of radiation, and the interpretations in the employment of iodized oil; the latter (C. J. R.) took a routine primary set and an individualized iodized oil set of films. The next step was to develop a form by which we as otolaryngologists could properly refer the case for examination with adequate accompanying information, just as any case which the X-ray department is called upon to examine. As above noted, the maxillary sinus work conforms to a routine. The suffusion work, however, will vary, especially in post-operative cases, and requires a form for proper recording in order to render the films



Fig. 10. Obs. No. 300 (cont'd). Erect-lateral, right.

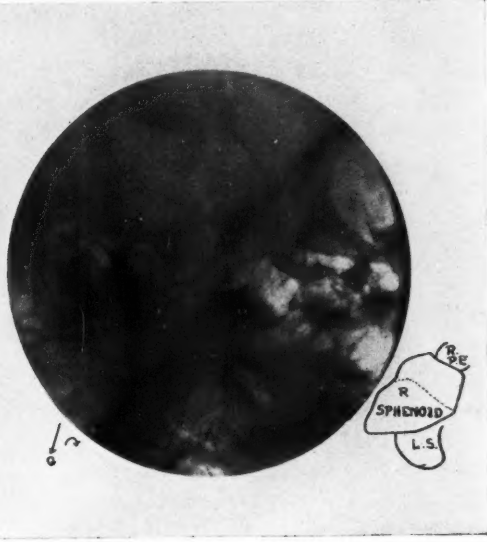


Fig. 11. Obs. No. 300 (cont'd). Erect-inclined, 35 degrees (L. temple; R. cheek), right.

intelligible (Fig. 8). The routine positions for the anterior series (prone position) are:

Prone-(30 degrees) lateral, oil and apparatus still in nose.

Prone-lateral, after evacuating.

Prone-Caldwell (postero-anterior).

Lateral-lateral (stereo).

Lateral, Waters.

For the inverted position (in view of the desire to retain the oil in the posterior series throughout):

Inverted-lateral, oil still in nose.

Inverted-vertical, after evacuating quickly.

Lateral-lateral (affected side) (stereo).

Lateral, Waters.

Supine-lateral.

Erect-lateral.

We not only take the laterals horizontally but also use vertical rays, and, for the ethmoid, an inclined position. Dr. E. C. Ernst states in his discussion of Dr. Proetz' original paper: "The types of sphenoid sinus filling defects must be developed similarly to the early gastric and duodenal roentgen-ray studies. Furthermore, the position of the patient may be changed or the direction of the ray through the sphenoid can be angulated so that both sinuses may be outlined in

the semilateral position." Such semilateral views are especially useful in the outlining of the upper ethmoidal row of cells, and, in the case of the sphenoids, to separate useful rim-like fillings which may be so symmetrical as to overlap disagreeably in the straight lateral. In the inverted position the ray enters the temporal fossa of the side concerned and throws the sphenoid and posterior ethmoids into the buccal space, between mandible and zygoma (Figs. 7 and 14). Figures 7 and 11 show the reverse of this ray suitable for the erect position of the head. The angle to the horizontal is about 35 degrees, which skims the slope of the horizontal plate of the frontal on one side and shows the extension of ethmoids above and lateral to the cribriform on the other.

Such is the distinctness of the lipiodol line and the superior orientation given by it, that many views may be made in the reverse of the ordinary direction. The study of the films merely follows the principles by which they are taken, aiming at detection of any abnormality and in positive cases grading the condition according to its significance

therapeutically. Of importance are swellings indicative of extreme chronicity (inability to resolve spontaneously, swellings interfering with the patency of operative openings, and lesions in locations inaccessible to the simpler types of operation). For diffuse uniform thickening of the mucoperichondrium, three degrees are to be recognized, based either on percentage of filling defect (15, 40, and 80 per cent, respectively), or on the linear height of the thickening,  $\mu$  (2 mm., 5 mm., and 10 mm., respectively, for the maxillary sinus) at standardized observation points, *e.g.*, posteriorly (Fig. 16) and again externally (Fig. 20) in the maxillary, medially and anteriorly (Fig. 18) in frontal, and anteriorly, posteriorly, and medially (Fig. 21) in the sphenoidal sinus. With our present technic, up to 1 mm. is regarded normal. The point of attachment of masses may frequently be named, and the irregularity and size approximately determined.

#### TYPES OF PROBLEM SUITABLE FOR OPAQUE STUDY

In order to illustrate the line of approach to different problems in the care of patients, and also indicate the validity of the method as compared with other methods of examination, four cases in which lipiodol was used will serve as examples. The commoner types of inflammation are not given, since they have been well illustrated in the literature (6, 13, 17, 30). It will be noted that the two negative cases, examined because of suspicion arising in the history or the rhinoscopic examination, were not punctured or probed.

In the illustrations the insertion of a curved arrow indicates a reversing (side to side) in the print.

No. 193, B. W., age 38, had come one year previously for marked chronic pharyngitis and laryngitis, and submucous resection had been performed by us at that time for

marked spur, right posterior. Meantime, during a subacute exacerbation, clear discharge had been observed coming from both sphenoids.

*Tentative diagnosis, Nov. 8, 1927:* Chronic catarrhal sphenoidal sinusitis with secondary pharyngitis. Lipiodol shows no filling defect (suffusion method: inverted position for posterior series and right anterior, Figs. 6, 8, 9, 10, 11).

*Treatment:* Aëration of sphenoidal region improved by partial mid-turbinectomy for small fleshy tags resulting from compression of the turbinates (spongy turbinates) at the time of the submucous resection. Subsequent medical treatment at home.

*Result:* Much improvement.

No. 148, Mrs. G., age 45, complaining of central headache, post-nasal mucus, and slight fever. Old antromeatal opening, right (patent), on irrigation through which a shred of discharge was obtained, with hemolytic streptococci. Subsequent irrigations were negative and a small filling defect to lipiodol injection disappeared also. The symptoms and some fluid discharge seen in the right sphenoidal region suggested a tentative clinical diagnosis of early chronic hyperplastic sinusitis, right posterior series. Opaque filling by displacement irrigation showed no filling defect (Figs. 12, 13, 14, 15). A rather favorable prognosis was given, with medical treatment. (Some authors would proceed with radical surgery without evidence of obstruction, chronic discharge, or thickening. Internists are usually insisting on all possible examinations before operating from history.) The films showed a value in the vertical technic and a distinct loss of oil in assuming the erect from the inverted position (Figs. 13, 15). The separation of the two sides in the 35-degree inclined position, with V-shaped divergence of the ethmoids, is shown (Fig. 14).





Fig. 12. Case No. 148, Obs. No. 298. Bilateral suffusion, inverted position. Horizontal radiation (left lateral) in original position. Normal findings. G, gravity.



Fig. 13. Obs. No. 298 (cont'd). Inverted-Bowen positions.

No. 174, S. F., age 34. Atrophic rhinitis case, with debility, chronic bronchitis, colitis, sharp febrile attacks. Rhinoscopy shows that no area of sinus drainage is free from the characteristic discharge. The purpose of the further examination was to discover the sites of the greatest lesions with the object of eliminating them one by one. Opaque injection showed first degree thickening of left maxillary, no discharge; ragged masses and second degree filling defect of right maxillary (Fig. 16), with granular pus discharge. Suffusion of upper sinuses showed fillings except right frontal. Prone position for right frontal also yielded no filling. It was, therefore, injected by cannula (pus and 95 per cent filling defect, Fig. 17). This sinus was not found clouded in the primary roentgenogram.

**Treatment:** Radical Caldwell-Luc, right maxillary; daily irrigation of frontal. This frontal now showed (one month later) only second degree filling defect (Fig. 18); much improved aëration.

No. 172, Mrs. C. Atrophic rhinitis, with many general bodily complaints. Referred by internist because of head and chest pains, with general toxemia. Discharge and crusts in all sinus areas of nasal fossæ; more on the right. Maxillaries and sphenoids cloudy to X-ray. Opaque injection of maxillaries revealed discharge and second degree filling defects (Fig. 20). *Streptococcus viridans* found. No further discharge in three further irrigations. Suffusion fills all right sinuses except right sphenoid. Irrigation and injection of right sphenoid *via* natural ostium shows third degree filling defect (Fig. 21).

**Diagnosis:** Atrophic rhinitis; chronic suppurative right sphenoidal sinusitis (left sphenoid proved negative).

**Treatment:** Irrigation for possible improvement, then surgery.

These atrophic rhinitis cases do not conform to the behavior of simple suppurative conditions which have the same gross anatomy. A popular treatment for the crusting

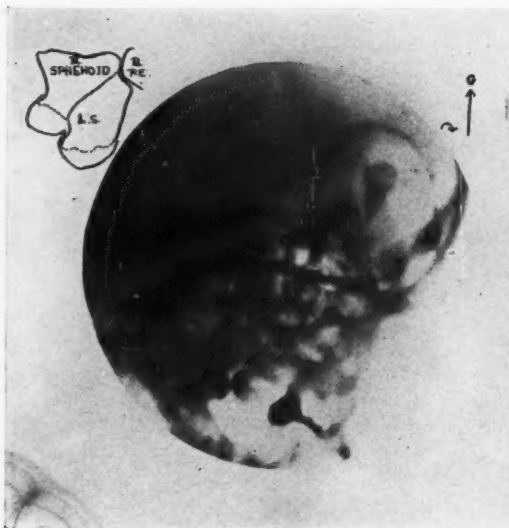


Fig. 14. Obs. No. 298 (cont'd). Inverted-inclined, 35 degrees (R. cheek; L. temple), for right posterior series.



Fig. 15. Obs. No. 298 (cont'd). Erect-Macfarlan (vertical). Some loss of lipiodol.

is to advance the lateral walls medially and secure adhesions to the septum. As this defeats intranasal treatment for sinusitis, it appears that thorough study of the sinuses might well precede this treatment. Obviously there is much to learn in the pathology of this disease.

The methods of examination used in these cases consisted in rhinoscopy (anterior, posterior, and *via* the Holmes nasopharyngoscope), transillumination (visible light), diagnostic irrigation (with bacteriologic examination of discharge and some palpation), and the primary roentgenogram. The history is frequently fallacious and of doubtful aid in guiding to a diagnosis due to confusion with nasopharyngitis, hay fever, vasomotor rhinitis, and other conditions such as crowding turbinates, which are confined to the nasal fossæ. Rhinoscopy fails in latent conditions of the sinuses and in those with watery or intermittent viscous discharge, and transillumination means nothing when negative in the investigation of hyperplastic sinusitis. It is often dark without significance, as shown by roent-

genogram, even when the opacity is unilateral. The routine X-ray requires granulations (blood) and pus for best reliability, and is most convincing only in the diagnosis of large masses in the large sinuses (frontal, maxillary).

#### NON-SUPPURATIVE FORMS OF SINUSITIS

No paper on this general subject would be complete without paying respect to that ubiquitous disease which takes heavy yearly toll among the best classes in our communities. Hundreds of thousands of the cases are asthmatics, and there is an equal number with quite different symptoms. A further army has advanced pathology and even polypi, but is without leading symptoms. The average case pays little attention to the catarrhal symptom, should he have the assistance of even that aid in calling attention to the nose as a source of ill-health. He complains, perhaps, of minor bronchial or eye symptoms, or of head or neck, perhaps of cardiac irregularity, vagotonia, anemia, or deafness, all of which can arise from a sinus without any pus.



Fig. 16. Case No. 174, Obs. No. 258. Atrophic rhinitis. Opaque injection right maxillary. Erect-lateral positions. Second degree filling defect, with granulation masses. A, bone line (from stereo). Surgery.



Fig. 17. Case No. 174, Obs. No. 276 (cont'd). Opaque injection right frontal, *via* cannula in frontal duct.

For the sake of clarity we may consider a brief classification of chronic sinusitis into—

Chronic suppurative sinusitis (in which maxillary and sphenoid predominate), and the following forms of non-suppurative sinusitis, listed in order of their progressive approach towards the purely infective type;

Chronic catarrhal sinusitis (thin discharge without strings, thickenings, or pus);

Chronic hyperplastic sinusitis (usually first and principally in the ethmoid);

(a) latent,

(b) with glairy discharge trailing into the nose, with or without retention,

(c) mixed (suppurative, the pus encysted deep in the membrane) and latent,

(d) mixed suppurative, with purulent surface discharge, with or without retention (empyema).

The etiology of and distinctions between these types are very imperfectly understood

and call for close observation of cases from both the local and general point of view.

#### SINUSES AND FOCAL INFECTION OR OTHER REMOTE EFFECTS OF INFLAMMATION

Absorption from pus within a sinus is not hard to diagnose. Absorption from small abscesses deep in a hyperplastic sinus (latent) with no surface discharge is more difficult. Constitutional symptoms produced indirectly from non-suppurative sinusitis, the bacterial nidus being in the nasopharynx, is a further severe test for older methods. Added to this, if we are to give a reliable answer to questions of spastic colitis, peribronchial thickenings, and the whole list of eye diseases now often blamed on the lowest grade and most inconspicuous sinus disturbances, we cannot have too many props for our disclaimers. We may sum up the importance to the internist by saying that the opaque injection and suffusion

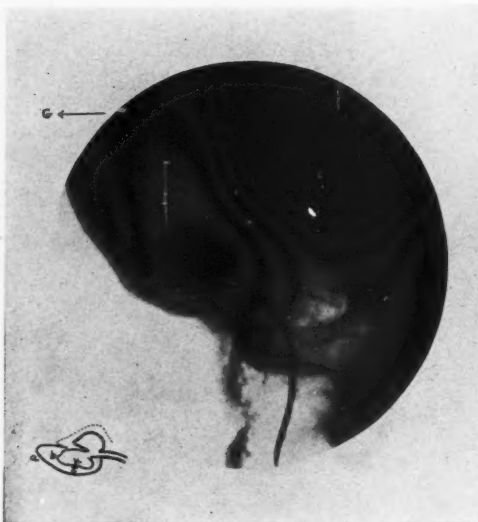


Fig. 18. Case No. 174, Obs. No. 295 (one month later). Injection right frontal; prone-lateral positions.



Fig. 19. Case No. 172, Obs. No. 268. Atrophic rhinitis. Suffusion right (adrenalin shrinking right). Inverted-lateral (oil still in nose). A, normal frontal.

methods more rigidly rule out adequate cause for arthritis, bronchitis, headache, etc., and in positive sinus patients who are debilitated or whose needs include other than rhinologic treatment, help secure the minimum effective surgical relief.

#### VALIDITY OF THE METHOD OF OPAQUE FILLING FOR THE RHINOLOGIST

Experience with a new method always includes contact with those rhinologists who have found some disappointment in it, of whom there is a small minority here and there. Their conclusion is that it involves more than other pre-operative diagnostic measures and they "do not need it." This would mean that they do not feel the need of anything (or that there are alternatives for all the benefits found in the use of iodized oil), but if one recalls the importance in internal diseases already mentioned and the reputation for lack of finality of cures in sinus surgery, he will be painfully conscious of each failure to diagnose. The

simple fact is that at best these cases are not well diagnosed. We attribute the aid received as a result of the iodized oil technics to the various precautions emphasized above, which definitely contribute to simplicity and directness in obtaining required information. Most important of all is to make one's beginning with the injection method in advanced cases, but reserve the displacement irrigation for such early cases as should approach normal findings.

If the best possible pre-operative diagnosis is not sought, the alternatives are not attractive. In the words of Hippocrates, lack of knowledge is the father of rashness on the one hand and timidity on the other. Over-radical surgery, while it relieves the young and robust, is denied the old and the frail, who should have a carefully measured and adapted treatment. The other alternative, when the patient's disability does not extend to the organs of locomotion, tends to produce the drifting patient. It is, however, an instance of over-specialization if these cases must be sent long dis-

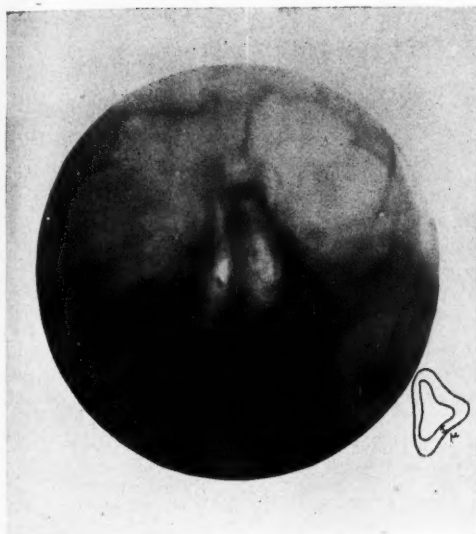


Fig. 20. Case No. 172 (cont'd). Opaque injection of maxillaries. R, lateral-Waters. Second degree filling defects. Palliative treatment.

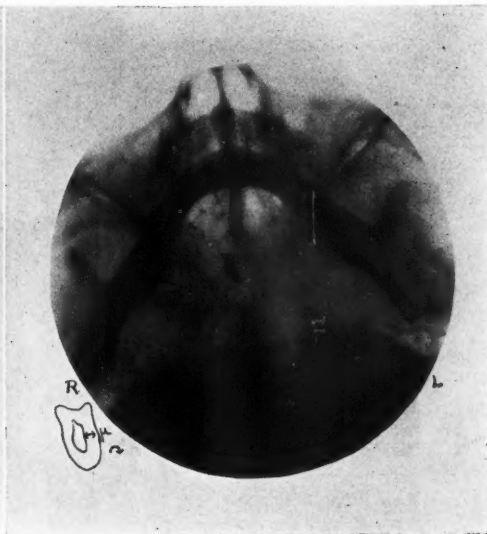


Fig. 21. Case No. 172 (cont'd). Opaque injection of right sphenoid. Macfarlan (vertical). Third degree filling defect. Surgery.

tances for their diagnosis and treatment. Each medical group should keep the (few) cases which require individualized methods and, taking a personal and research interest in them, attain results quite as good as those of the remote specialist, whose number of cases would otherwise be too large to receive individual sympathetic study.

#### RÔLE OF IODIZED OIL IN SURGICAL PRACTICE

The following substantial advantages may be expected if a commensurate degree of attention is given to the case:

1. Exclusion from the list of pathologic diagnosis of any sinus which, solely because of anatomical peculiarity, is cloudy to transillumination and primary roentgen-ray examination.

2. Exclusion of unaffected sinuses, *e.g.*, sphenoid, maxillary, or frontal in hyperplastic ethmoiditis. Also extension to the sinuses of neighborhood inflammation or malignant growth (McKelvie, 19).

3. The revealing of such pathologic anatomy as serves as a check on progress

under conservative treatment over a period of time (Weil, 34).

4. Contribution to statistics, so highly desirable as to what grades of anatomical change in the various inflammations are capable of resolution without radical surgery.

5. Guidance in the type of operation to be used and the direction of approach and of drainage (Reverchon and Worms, 30).

6. Demonstration of the pathologic material which is to be removed, with site of attachment of polypi, etc. (Brunetti and Filippini, 3).

7. A check on the success or failure of any preceding surgical procedure.

8. Encouragement for conservative treatment in bad risk cases or when annoying chronic symptoms might ensue and be blamed against the operation.

#### SUMMARY

Experience with iodized oil in the sinuses is maturing into feasible routine methods for use in baffling rhinologic cases.

There are a number of principles demand-



ing observance. The standard direction of radiation is horizontal but use of dilutions of the lipiodol, stereo positions, and certain directions of oblique, inclined, and vertical radiation often quickly excludes pathology. The geometric character of the paranasal cells is reviewed from this point of view. Complete fillings are most useful and are obtained by injection, which is the more frequent method of choice in the presence of outspoken disease. Small rim floor fillings are helpful in the sphenoids. Displacement (suffusion) fillings are the method of choice for the smaller sinuses and for early cases: they give evidence of choked sinus, or filling defect, or delayed emptying (Proetz). Examinations in the original position of the filling are valuable.

From a purely roentgenographic point of view, the method (1) reveals beginning changes earlier, demarcating soft tissue growth; (2) multiplies the number or extent of separation lines, rendering them capable of interpretation; (3) results in the reporting of thicknesses and masses as well as density. The reports are in concrete physical terms, avoiding terms of pathologic diagnosis in cases in which the roentgen finding is not pathognomonic.

In the relationship of the roentgenologist to the rhinologist and the internist co-operation is furthered by proper use of opaque fillings. Disagreement in such cases as the cloudy sinus with no discharge (poly-pi present) is avoided. In probably negative cases, insistent demands of the clinician for additional help may be acceded to by way of these special examinations, which, when made, will establish important evidence of normality in the face of vague constitutional suspicions upon the sinuses. (Need of surgery upon the maxillary sinus may be completely excluded.) A good basic routine for the sinus mapping of cases, by rhinologist and roentgenologist, respectively, can be arrived at, with report forms as

outlined, insuring proper responsibility for records made and final reports issued.

Disease findings constitute a diagnosis of *degree*, permitting selection of treatment from the extensive list of rhinologic procedures and surgery. Light is given on the avenue of approach and type of drainage desirable in surgery. In many cases of chronic hyperplastic sinusitis no valid opinion can be offered without these methods. The shortcomings of rhinoscopy, transillumination, history, etc., are best appreciated in the success of treatment. Statistical classification should come after longer experience. Tumors, invasions, anatomical peculiarities, and non-opaque foreign bodies are naturally rarer fields of usefulness. The obscurities of the pathology (course and influences) of a number of disease forms, such as atrophic rhinitis, will be investigated through filling defects and a stimulus be given thereby to non-physical research methods. The methods described provide a definite opportunity for any group with standard equipment, whose effort will be rewarded both by the interest found in this work and the increased usefulness to the patient. The interest and co-operation of the patient is a worthy goal in itself. In our present experience it is never necessary to remain in a quandary about a sinus which one can examine by the saving aid of lipiodol.

#### REFERENCES

- (1) ASPRAY, J., and HERPEL, F. K.: Technic for roentgenologic examination of nasal accessory sinuses. *Am. Jour. Roentgenol. and Rad. Ther.*, December, 1924, XII, 573.
- (2) BOWEN, DAVID R.: Roentgen examination of sphenoidal sinus, presenting vertical technic. *Am. Jour. Roentgenol.*, October, 1914, I, 449.
- (3) BRUNETTI, L., and FILIPPINI, G.: Sull' impiego di sali opachi nella dimostrazione radiografica dell' antro d'Higmore e di cisti del mascellare superiore. *Radiologia Medica*, August, 1924, XI, 8, p. 469.
- (4) CALDWELL, E. W.: Skiagraphy of accessory sinuses of nose. *Am. Jour. Roentgenol.*, December, 1918, V, 569.
- (5) Idem: Further observations on roentgen-ray examination of accessory nasal sinuses. *Laryngoscope*, November, 1908, XVIII, 853.

- (6) DOBRZANSKI, A., and LENARTOWSKI, H.: Sur l'application du lipiodol dans le diagnostic radiologique des maladies du sinus maxillaire. *Jour. de mal. de l'oreille, etc.*, July, 1926.
- (7) DREA, W. F.: Polypoid tissue in maxillary antra: X-ray diagnosis. *Ann. Otol., Rhinol., and Laryngol.*, June, 1927, XXXVI, 341.
- (8) FORESTIER, J.: L'huile iodée en pratique radiologique. *Paris Méd.*, April, 1924, LI, 377.
- (9) FRASER, R. H.: Iodized oil (lipiodol) in otolaryngologic diagnosis. *Jour. Mich. St. Med. Soc.*, June, 1926, XXV, 270.
- (10) Idem: Rôle of opaque injection and suffusion in standardization of paranasal sinus surgery. Read before Sect., Michigan Med. Soc., September, 1926.
- (11) Idem: Die Kontrastfüllung in der oto-rhinologischen Diagnostik. *Monatschr. f. Ohrenh. u. Laryngo-Rhinol.*, Vienna, July, 1927, LXI, 802.
- (12) Idem: Instruments for injection of iodized oil into sinuses. *Arch. Otolaryngol.*, March, 1928, VII, 258.
- (13) GOODYEAR, HENRY M.: Iodized oil in diagnosis of nasal sinus conditions. *Arch. Otolaryngol.*, September, 1926, IV, 223.
- (14) GRANGER, A.: New technic for positive identification of sphenoid sinus and ethmoid cells. *Jour. Radiol.*, April, 1923, IV, 105.
- (15) Idem: Positive identification of sphenoid and ethmoid sinuses. *Jour. Am. Med. Assn.*, Oct. 20, 1923, LXXXI, 1336.
- (16) HUBENY, MAXIMILIAN J.: Injection of sphenoid sinuses with suspension of barium sulphate. *Jour. Radiol.*, March, 1921.
- (17) MACCREADY, P. B.: Iodized oil as aid in diagnosis of chronic sinusitis and maxillary cysts. *Boston Med. and Surg. Jour.*, Sept. 2, 1926, CXCIV, 464.
- (18) MACFARLAN, DOUGLAS: Radiography of nasal sinuses. *Laryngoscope*, May, 1914, XXIV, 48.
- (19) McKELVIE, B.: Aid to radiography of maxillary antrum. *Brit. Med. Jour.*, July 10, 1926, p. 58.
- (20) PFAHLER, G. E.: Value of roentgen rays in diagnosis of diseases of accessory sinuses, with new technic for sphenoid. *Laryngoscope*, July, 1916, XXVI, 1018.
- (21) PROETZ, ARTHUR W.: Displacement irrigation, new method, etc., *Trans. Washington Univ. Med. Soc.*, Dec. 14, 1925.
- (22) Idem: Displacement irrigation of nasal sinuses: new procedure in diagnosis and conservative treatment. *Arch. Otolaryngol.*, July, 1926, IV, 1.
- (23) Idem: New procedure in sinus diagnosis. *Trans. Am. Laryngol. Assn.*, June, 1926, pp. 252-257.
- (24) Idem: Displacement irrigation of nasal sinuses: new procedure in diagnosis and conservative treatment. *Jour. Mo. St. Med. Assn.*, May, 1927, XXIV, 229.
- (25) Idem: Physics of sinus drainage. *Ann. Otol., Rhinol., and Laryngol.*, March, 1927, XXXVI, 23.
- (26) Idem: Further data on displacement method in sinuses. *Ann. Otol., Rhinol., and Laryngol.*, June, 1927, XXXVI, 297-323.
- (27) Idem: Visualization of sphenoid, with studies of exposed pterygoid canal. *Trans. Washington Univ. Med. Soc.*, Oct. 10, 1927.
- (28) Idem: Visualization of sinus drainage. *Ann. Otol., Rhinol., and Laryngol.*, December, 1927, XXXVI, 978-990.
- (29) PROETZ, A. W., and ERNST, E. C.: Sinus mapping by displacement method. *RADIOLOGY*, June, 1927, VIII, 502-511.
- (30) REVERCHON, L., and WORMS, G.: L'exploration radiologique par lipiodol en oto-rhinolaryngologie. *Rev. de Laryngol., d'Otol., et de Rhinol.*, 1925, XLVI, 186-193.
- (31) SICARD, J. A., and FORESTIER, J.: Méthode générale d'exploration radiologique par l'huile iodée (lipiodol). *Bull. et mém. Soc. méd. d. hôp. de Paris*, March, 1922, XLVI, 463.
- (32) WATERS, C. A., and DOUB, H. P.: Roentgen diagnosis of polypi of maxillary sinuses. *Am. Jour. Roentgenol.*, September, 1917, IV, 470.
- (33) WATERS, C. A., and WALDRON, CARL W.: Roentgenology of accessory nasal sinuses, describing modification of occipito-frontal position. *Am. Jour. Roentgenol.*, February, 1915, II, 633.
- (34) WEIL, MORIZ: *Wien. klin. Wchnschr.*, 1903, Nr. 52, p. 1471.
- (35) Idem: *Wien. klin. Wchnschr.*, 1904, Nr. 2, p. 61.
- (36) Idem: *Med. Klin.*, 1923, Nr. 10, p. 329.

## DISCUSSION

DR. P. M. HICKEY (Ann Arbor, Mich.): With regard to the use of lipiodol in the spinal canal, I personally have had only a rather limited experience. One case, a tumor in the cervical region, was beautifully outlined by the use of the lipiodol ascendens and lipiodol descendens. The tumor in this case was localized much more exactly than was possible from the neurologic symptoms. The patient was operated on and made an uneventful recovery, with complete relief from the symptoms from which she had suffered. In this case, though, the neurologic surgeon injected more than the usual amount of lipiodol, so that the patient at present has numerous globules of iodized oil through the cranial cavity; however, she does not seem to be showing symptoms from them.

We have also used lipiodol in the case of an advanced Charcot disintegration of the spine in the lumbar area, where it was thought to be advantageous to ascertain whether there was any real pressure from the disintegrating vertebræ upon the spinal

cord. The lipiodol was put in by lumbar puncture and we had the satisfaction of seeing it ascend easily, showing that the spinal canal was not blocked.

I became interested very early in the use of lipiodol in the lungs and so we have used it in several hundred cases. From the standpoint of our experience I would like to emphasize the advantage of the fluoroscopic examination. The fluoroscopic image during the first few seconds after the injection gives you more correct information about the distribution of the lipiodol than the plates which are made later. With regard to the plates which are made in addition to the usual fluoroscopic examination, we have found that the lateral projection is of the greatest value in the definite localization of the lesion. In this country the transglottic method is used more extensively than any of the others which have been recommended, but I do think that the injection through the cricothyroid membrane offers in some cases certain advantages. It is really a very simple procedure, particularly applicable for children. I remember one girl, eight years of age, who seemed in a highly nervous state and was accompanied by a very neurotic mother. In that case the injection was made through the cricothyroid membrane with no disturbance of the patient. It turned out to be very much worth while, because the case was one of large sacculations in an advanced bronchiectasis.

In cases of asthma we have noticed that the lipiodol passes on into the alveoli very rapidly; here, too, one must rely principally on the fluoroscopic examination for the determination of the caliber of the bronchi.

With regard to the question which Dr. Nichols brought up about the therapeutic value of lipiodol, we might mention that some twenty-five years ago the intratracheal injection of medicated oils by means of the laryngeal syringe was a common procedure and it was felt at that time that the rather

striking beneficial results were due in part to mechanical cleansing of the bronchi. So it may be true that some of the good results which we see following the injection of lipiodol may be due to the mechanical cleansing.

I would like to report one case in which there were rather alarming symptoms following the diagnostic use of lipiodol. On the second day after the injection the patient's temperature went up to 104° and he was very ill for a number of days. The physical findings and the X-ray films were highly suggestive of atelectasis, and following pneumothorax the patient made a complete recovery. In this case the contraindications of a slight temperature were not given the proper evaluation.

DR. L. R. SANTE (St. Louis): I am sure we have all been impressed with the limitations of the ordinary methods of radiographing paranasal sinuses. The examination, as it is ordinarily conducted, permits little more to be said than that pathology exists. To be of value our examination should deal with the position of the sinuses and make a thorough analysis of the pathology present. With the ordinary radiographic examination, beyond the statement that there is pathology I think we must go only with the greatest of hesitation. We cannot, for instance, with any degree of certainty say whether or not this pathology is recent or whether it is chronic, whether it is due to granulations, to thickness in mucous membrane, or to abnormal newgrowth. In certain instances these differences can be noted, but in a great majority of cases, I am sure, we must admit there is no certainty. In this new method of injection of lipiodol into the nasal sinuses we have a valuable help in diagnosis. Dr. Fraser's paper, presenting this method, was interesting. I have not yet been able to carry out Dr. Proetz and Dr. Ernst's technic with any degree of

satisfaction, but I attribute this more to the fact that I am not fully familiar with the anatomy of the nose and paranasal sinuses. This technic should not be attempted until one has become familiar with the local anatomy; at least, it should be carried out in conjunction with the rhinologist in the beginning.

Dr. Nichols' subject, the injection of lipiodol in the chest, was well covered in his paper and also by Dr. Forestier in his clinic. There is only one thing I should like to add and that is a word of caution against the use of the direct injection with a needle of this oil into the trachea in certain instances. The cases to which I refer are those in which there is chronic lung suppuration, associated with putrefactive organisms. The needle inserted into the trachea becomes contaminated with these organisms and, on withdrawal, inoculates the deep cellular tissues of the neck. It is a measure which causes a dangerous condition. We have also had the experience, in the injection of lipiodol by this method without doing it in front of the fluoroscope, of actually injecting part of the oil into the surrounding connective tissue. I think we should be very careful in cases of this type in attempting direct injection. It is the easier method, but in certain instances the direct injection of lipiodol into the trachea by needle is contra-indicated.

DR. HOWARD P. DOUB (Detroit): I wish to say a few words regarding Dr. Fraser's paper. I have been doing some of this work on the paranasal sinuses and in certain cases it has helped us a great deal, while in other cases no benefit has been derived. I would like to state, however, that in the latter type of cases we have not, so far, been able to exactly duplicate the technic of Dr. Fraser, and I do not believe, therefore, that these cases should be allowed to detract from the method. In many cases one can

demonstrate chronic pathology in the sinuses, with thickening of the mucous membrane and polypoid degeneration.

I would like to ask Dr. Forestier one question. Would he tell us his experience in regard to the mortality of using lipiodol in the spinal canal? Some of the men in this country have felt that it was a dangerous medium to use in cases of this kind.

Dr. Nichols' paper is a very valuable one. I believe that there is a growing conviction in the minds of many men throughout this country that the indiscriminate introduction of lipiodol into the lungs is a dangerous practice. In order to derive the greatest benefit special technic is necessary and this technic may have to be varied in different cases. In cases where a large portion of the lungs is involved by disease one may encounter serious consequences in filling up the remaining normal lung.

In cases of lung abscess we have frequently been disappointed in not being able to fill the cavity. In these cases there is considerable swelling of the tissues around the opening, which prevents the lipiodol from flowing into it easily.

I believe that the rôle of lipiodol in the diagnosis of chest tumors is limited to outlining the normal lung around the tumor with lipiodol and demonstrating non-filling of the tumor area. In these cases it is frequently of considerable benefit. We have used lipiodol in lung abscess cases following thoracotomy by filling the cavity with gauze impregnated with lipiodol. A small amount of lipiodol will suffice for this purpose and it is very readily removed later.

I would like to bring to your attention once again a thing that has been emphasized before and that needs to be kept constantly in mind. It is the danger of diagnosing tuberculosis of the lungs in cases where lipiodol has been introduced into the lung and not entirely evacuated. This has been called to my attention several times recently by see-

ing cases of this type. I believe that it is true that a great many cases have been diagnosed as having tuberculosis which did not have it.

DR. I. SETH HIRSCH (New York): In describing the use of gas or lipiodol for determination of tubal patency, Dr. Rubin<sup>1</sup> enumerated the dangers of the injection methods. I would like to show you a simple method I have devised of testing for tubal patency. It is free from the dangers cited. Bismuth or barium is mixed with cocoa butter and a little vaseline to make a bougie. This is deposited into the uterine canal without force or pressure. The heat of the body melts this bougie and the fragments of contrast material are carried into the uterus and tubes. In one hour the tube is definitely outlined and in two hours the contrast particles may be seen in the peritoneal cavity.

This method is therefore interesting, not only from a diagnostic standpoint, but also from the physiological standpoint. If a

very small quantity of contrast mixture deposited in the cervical canal will, if the tubes are patent, be carried into the peritoneal cavity, we have in such a method a truly simple and harmless test. I have checked up by the lipiodol injection cases in which this test was negative, that is, the barium did not travel beyond the uterine cavity, and by cases in which the test was positive in that the barium travelled freely into the peritoneal cavity, and have found that the result tallies.

DR. W. O. UPSON (Battle Creek, Mich.): Two or three points in the lipiodol fillings in the sinuses are especially interesting to me as a radiologist. We have been aware that the information which we have been giving the otolaryngologist by ordinary methods left something to be desired—we were glad to co-operate in further work in special or difficult cases. We found we were able to secure more detailed information by the methods given, and the patient was the one who benefited by it. Our experience has extended to some three hundred cases.

<sup>1</sup>Rubin, I. C.: Diagnostic Use of Intra-uterine Iodized Oil Injection Combined with the X-rays, Compared to Peruterine CO<sub>2</sub> Insufflation: A Study Based on 66 Cases of Tubal Obstruction. RADIOLOGY, August, 1928, XI, 115.



## ANALGESIC PROPERTIES OF THE X-RAY<sup>1</sup>

By L. J. CARTER, B.A., M.D., C.M., F.A.C.P., the Bigelow Clinic.  
BRANDON, MANITOBA

**R**ADIOLOGISTS have been so engrossed with the larger problems of diagnosis and treatment that they have frequently not sufficiently emphasized the commoner conditions in which the X-ray may be of great service. In the relief afforded from many types of pain, X-ray therapy possesses almost specific value.

The writer has searched the *Journals* of the two great American associations, published during the last ten years, for original contributions discussing the use of the X-ray in the relief of pain, and has found very few.

In 1921, G. E. Richards (1), in discussing before the Radiological Society some of the less common uses of X-ray therapy, called attention to its value in controlling the painful seizures of tic douloureux: "More help," he stated, "can be afforded sufferers from this terrible malady than is being accomplished."

In 1925, before the American Roentgen Ray Society, C. A. Pfender (2) discussed "The Roentgen Treatment of Chronic Spondylitis Deformans," and emphasized, from his own experience and that of others, the great value of the X-ray in relieving the pain of this condition, especially when used in the early stages and in smaller doses. He ascribed the pain of spondylitis to "pressure on the nerve through the vertebral foramen." He attributed the relief from pain to the action of the ray in reducing inflammation and swelling in the connective tissue surrounding the nerve and compressing it in the intervertebral foramen.

In 1926, before the Radiological Society, A. U. Desjardins (3) dealt in a comprehensive way with the general subject, "An-

algesic Property of Roentgen Rays." He attributed the unfamiliarity of physicians in general, and radiologists in particular, with the pain-relieving properties of the roentgen ray, to the fact that such pain relief is concomitant with, and often overshadowed by, the other beneficial effects of X-ray therapy. He enumerated striking illustrations of the relief from pain obtained in such conditions as malignancies, corns and callosities of the feet, chronic arthritis, furuncles and carbuncles, and phlebitis. He suggested the relief as possibly being due to the reduction of swelling and relief of pressure on the nerve, but more probably to a true specific analgesic action on the nerve cells themselves.

The writer, in co-operation with the other members of the Bigelow Clinic, has for many years been using the X-ray for the relief of various types of pain. The results have been so uniformly good, and the field of application so constantly widening, that he has thought it wise to review and report some of these results.

The conditions in which the most striking relief from pain has been secured have been trigeminal neuralgia, chronic mastitis, paresthesias of the tongue, some forms of osteo-arthritis, herpes zoster, inoperable malignancies, furunculosis and carbuncle, pelvic inflammations, inflammatory bands and adhesions involving gall bladder, duodenum, ileocecal and rectosigmoid regions, and tuberculous peritonitis.

### TRIGEMINAL NEURALGIA (TIC DOULOUREUX)

Four years ago a man who had previously had a gasserian ganglion resection for the relief of a left-sided trigeminal neu-

<sup>1</sup>Read before the Radiological Society of North America, at the Thirteenth Annual Meeting, at New Orleans, Nov. 28-Dec 2, 1927.

ralgia, returned to the clinic where the former operation had been performed, with return of the pain on the other side. He was advised to have the other ganglion removed. This advice he did not follow, since he had had some difficulty in swallowing food following the former operation. Some friends, having heard of the use of the X-ray in this condition, referred him to me. Following the first treatment he obtained some relief. Two more treatments followed, at intervals of two weeks, with greater improvement each time. One month later he returned for a second series. The pain had completely disappeared. One year later, having been free from pain in the meantime, he visited the Pacific coast. While there the trouble returned, and he received a series of treatments with, he states, no relief. Immediately following this series of treatments he fell into the hands of a faith-cure parson, and was "cured" of his distress. Thus faith-healing obtained the credit for what was undoubtedly a delayed reaction from the X-ray exposures (a delayed reaction is a matter of common observation among X-ray workers). He remained pain-free for nearly two years, but returned to me two months ago with another recurrence. Under further treatment the seizures at first began to lessen, then there was a severe exacerbation, followed by sudden and complete relief. This man will continue to have these periodic recurrences, and will require occasional X-ray exposures to keep him comfortable. With moderate dosage, good filtration, and suitable intervals, there need be no fear of skin damage, such as the production of a telangiectasis.

A similar case illustrates not only the value of the type of treatment, but also reveals the ignorance concerning its possibilities which exists among our medical and surgical confrères. While attending a district medical meeting I discussed with a lo-

cal physician and a leading surgeon a case of *tic douloureux* for which they were considering resection of the gasserian ganglion. Neither had ever heard of X-ray being used in such a condition. I persuaded them to let me try X-ray therapy before they submitted the patient to such a dangerous operation as they contemplated. The next day the patient came on a stretcher—she had been constantly under morphia for two weeks without relief. A treatment was given and the patient was sent to the hospital. Five days later a second treatment was given. Immediately following this second treatment there was sudden and complete relief from pain. Two weeks later there was a return of the spasms but in a lesser degree. A treatment at this time was followed by prompt cessation of the spasm. Two months have elapsed since that time, during which the patient has had a second series of treatments. There has been no return of the trouble.

These two cases are not isolated examples: we have many other similar records. It is such results as these that give rise to profound gratitude on the part of the patient, and make the radiologist an enthusiast in his work.

As already intimated, the types of neuralgia and neuritis which yield most brilliant results from X-ray therapy are those in which the affected part of the nerve is so situated in a bony canal that it is compressed by the inflammatory swelling. This may be true of the gasserian ganglion as it lies in its fossa on the anterior part of the petrous portion of the temporal bone. It is also true of the intercostal and lumbar nerves as they pass out through the intervertebral foramina. It is the general experience that nerve lesions so situated that the inflammatory swelling is not subject to compression do not secure the same symptomatic benefit, but nevertheless they too re-

ceive a great deal of relief from X-ray exposures.

#### OSTEO-ARTHRITIS

What has just been stated concerning the results obtained from the X-ray treatment of neuralgias and neuritis generally is also true of osteo-arthritis pain particularly.

That form of osteo-arthritis which gives rise to pressure on an emerging nerve, thus setting up a confined neuritis, will receive most benefit from X-ray exposures. While much may not be expected in the way of absorption of the osteo-arthritis deposit, yet the X-ray treatment will give relief from the neuritic pain—a relief which is often surprisingly permanent, although the arthritic deposit itself may not be greatly changed.

The types of osteo-arthritis which have yielded best results are the so-called lumbagos, which are usually neuritis of a lumbar nerve, impinged upon as it emerges from the intervertebral foramen, and the sciaticas associated with arthritis in the sacro-iliac articulation.

#### HERPES ZOSTER

Herpes zoster may be considered as somewhat allied to trigeminal neuralgia, since both are inflammations of the nerve ganglion. The pain from this condition is capable of relief by the application of radio-therapeutic methods.

A patient, in whom the herpes zoster had progressed to a chronic stage, secured the first night's sleep in two months, following an X-ray treatment.

#### CHRONIC MASTITIS

The widespread propaganda for the early recognition of cancer of the breast is bringing an ever-increasing number of female patients to have suspicious lumps examined. In a great many cases the breast condition proves to be a chronic mastitis, accompanied by considerable enlargement and

more or less pain. Such cases may not require operation. Under moderate X-ray exposures the swelling subsides and the discomfort is relieved. Our experience in the X-ray treatment of this condition has been particularly encouraging. In only one instance was it necessary to resort to amputation, a series of eight treatments having failed to give relief from pain or reduce the size of the greatly enlarged breast. Pathologic report on this breast was embryonic fibroma. Some forty cases yielded brilliant results. The patient must be warned, however, not to expect rapid improvement at first. In many of the cases in this series relief was not obtained until after three or four treatments, extending over a period of about a month, had been given.

#### PARESTHESIAS OF THE TONGUE

Painful affections of the tongue are fairly common. There may be a simple paresthesia, for which no cause may be discoverable; it may result from a fissure, a papillitis or a papillary hyperplasia, a glossitis, or a frank ulceration. All types are amenable to relief from pain through X-ray treatment—some yield results quickly, others are highly resistant; all will yield good results if the treatment is persisted in. In no case of this series has there been a failure when the patient followed our instructions.

#### ABDOMINAL AND PELVIC INFLAMMATORY BANDS AND ADHESIONS

The commonest sites of inflammatory bands and adhesions in the abdominal cavity are the gall bladder, duodenum, and the ileocecal and rectosigmoid regions. It is not to be expected that these will be susceptible of removal except by surgical measures, yet it is often surprising to note the relief which may be obtained by systematic X-ray treatment over these affected areas. Similarly, pelvic inflammations which have not gone on to the point of pus formation may be

markedly absorbed by the X-ray, with accompanying relief from pain.

It has been frequently taught that the presence of inflammatory lesions in the pelvis constitutes a contra-indication to the X-ray treatment of hemorrhage from a uterine fibroid or occasioned by the menopause. The writer has found, in his experience, that just the opposite is the case. Where pus formation, such as a pyosalpinx, can be ruled out by careful bimanual examination, the pain will be greatly relieved and the inflammatory exudate absorbed, by series of X-ray exposures sufficient to control the hemorrhage or reduce the fibroid.

A patient with a large inflammatory mass in the left pelvis, fixing the uterus to that side, was submitted to a series of X-ray exposures to control a menopause menorrhagia from a fibroid uterus. When sufficient treatment had been given to stop the hemorrhage and reduce the fibroid uterus to normal size the left pelvic mass had completely disappeared, and the uterus was freely movable in the pelvic cavity.

An analogous condition is that referred to by the writer, in a case report published in the December, 1925, issue of RADIOLOGY. A uterus on which, some years previously, there had been done a low ventral fixation, became the site of fibroid enlargement, accompanied by hemorrhage. There was pressure on the bladder, forcing the base downward, with resulting pain and tenesmus. Operation was advised, but refused. X-ray therapy was instituted with the hope that, when the hemorrhage was controlled, the fibroid would be found sufficiently reduced to relieve the bladder pressure and stop the pain. Since the publication of that case report four series of X-ray treatments have been given. The hemorrhage has been controlled, the uterus reduced to half its former size, and the bladder pain and tenesmus much relieved.

The beneficial effect of X-ray therapy on

the discomfort caused by chronic duodenal adhesions is well illustrated by the following case.

The patient came to the Clinic in 1917, complaining of discomfort in the duodenal region, accompanied by heartburn and eructations of very sour, burning gas. The barium series demonstrated a greatly dilated duodenal cap, with extensive adhesions involving the second portion of the duodenum. Rigid medical treatment was instituted, covering a period of two years, without permanent relief. Operation was then resorted to. An old perforated abscess of the liver was discovered, with highly organized adhesions, extending from the scar, across the gall bladder and the second portion of the duodenum. The first part of the duodenum was markedly dilated. The adhesions were removed, with subsequent great relief from symptoms. One year later the distress returned. X-ray examination at this time showed the duodenal cap still dilated, but there was no evidence of constricting bands of the second portion. Marked hyperacidity was present. Evidently the adhesions had not reformed, but the long-dilated duodenal cap had not been able to restore its lost muscular tone. A series of X-ray treatments was advised, and two a month were given for four months. Relief from symptoms was prompt and continued for a period of one year. At the expiration of that time the symptoms again returned. A second series of X-ray treatments was given, extending over three months. Relief was again obtained, and to this date the trouble has not returned, although four years have elapsed.

#### FURUNCULOSIS AND CARBUNCLE

The pain from these conditions is relieved and the inflammatory exudate reduced by X-ray therapy. No carbuncle should be dissected out without first trying a series of X-ray treatments. Following such treat-



ments the pain is controlled, and the inflammatory exudate softened and reduced in amount. Excision, if then required, will be rendered much easier and much safer.

#### INOPERABLE MALIGNANCIES

Radiologists are frequently confronted with the problem of the inoperable malignancy. The pain from such a condition may be alleviated and often completely relieved by the use of the X-ray. Occasionally the tumor will disappear, and, rarely, the patient will apparently recover completely. Apart from the question of the type of X-ray treatment to be used in these inoperable malignancies—a question which it is not the purpose of this paper to discuss—the relief from pain which may be obtained from any type of X-ray treatment is greatly worth while. To make painless and comparatively comfortable the exitus of the victim of this dread malady should not be beyond the ambition of any physician.

#### TUBERCULOUS PERITONITIS

The X-ray as a therapeutic agency in tuberculous peritonitis has long been recognized as a valuable aid in the cure of that condition. The relief of pain following a series of X-ray exposures over the abdomen, even where the operation discloses massive adhesions, is noteworthy. To have rendered a patient comfortable during the long and tedious convalescence characteristic of this disease, such as can be accomplished from the beginning by the use of the X-ray, is something well worth while, apart even from the well known curative properties of the ray.

#### DOSAGE

When X-ray therapy is instituted primarily for the relief of pain the one thing that must emphatically be borne in mind is that heavy dosage should not be used. Much

better and safer results will be secured from the smaller dosage. Kilovoltage should be limited to the minimum amount adequate to give the desired penetration, while milliamperage and time should not exceed the amount necessary to produce the analgesic effect.

In trigeminal neuralgia, chronic mastitis, herpes zoster, furunculosis and carbuncle, abdominal and pelvic inflammatory adhesions, and tuberculous peritonitis the following factors have been found the most effective: 113 peak kilovolts (9 inch spark gap); 5 ma.; 10 inch focal skin distance; 5 mm. aluminum and 6 mm. sole leather filter; 5 minutes. This dosage is repeated once a week until relief from pain is well established, and then the intervals are increased and the treatment continued according to the needs and progress of the individual patient and the particular disease treated.

The tongue paresthesias are treated in the same way as benign skin lesions, namely, by unfiltered radiation. The following factors have been found effective: 63 kilovolts (5 inch spark gap); 3 ma.; 8 inch focal skin distance; 3 minutes. This is repeated in from five to seven days. It should not be continued longer than three or four treatments without increasing the interval between treatments.

#### CONCLUSIONS

The conclusions drawn from this series are based on an experience with 115 cases, in which a total of 950 individual treatments have been administered.

The treatments have not in the majority of cases been given only for the relief of pain. There has always been a twofold objective in view—to relieve pain and to correct the disease lying behind it.

The objective, as far as relief of pain is concerned, has been almost invariably at-



tained. The removal of the underlying cause has been accomplished in a degree sufficient, in co-operation with other well-recognized therapeutic procedures, to warrant its use as a routine therapeutic agent in the diseases noted.

The writer hopes that this re-emphasis on the analgesic properties of the X-ray will stimulate radiologists, and, through them, the general medical profession with whom they consult, to give to their patients the great advantages which accrue through the use of the X-ray as a therapeutic measure in the control of pain.

#### REFERENCES

- (1) RICHARDS, G. E.: Jour. Radiol., July, 1922, page 271.
- (2) PFENDER, C. A.: Am. Jour. Roentgenol. and Rad. Ther., June, 1925, page 551.
- (3) DESJARDINS, A. U.: RADIOLOGY, April, 1927, page 317.

#### DISCUSSION

DR. A. U. DESJARDINS (Rochester, Minn.): I should like to say a few words about the subject of Dr. Carter's paper, because I have been interested in this phase of radiology for a long time. Almost from the beginning of my interest in radiotherapy I noticed the more or less striking analgesic effect of radiation in certain cases. This effect was observed, not only in connection with different varieties of tumors, but also in connection with benign conditions. So far as tumors are concerned, an increasing number of patients are being treated for pain-relief alone. The condition of many patients is such that nothing more can be accomplished, but relief from pain is one of the chief duties of the physician, and many otherwise hopeless cases can be given such relief by radiotherapy.

Carcinoma of the breast or of the uterine cervix often metastasizes to the spine or to the prevertebral lymph nodes, generally in the lumbar region. This is often associated

with pain in the back, radiating to one or both hips and lower extremities. Such pain can be relieved by adequate roentgen-ray treatment in a large proportion of cases and this relief lasts sometimes until death. In most cases, however, pain reappears later. Sometimes, but not always, the treatment can be repeated with good effect. The interval between treatment and abolition of pain in the case of tumors is roughly proportional to the radiosensitiveness of the tumor.

The analgesic effect of roentgen rays is not confined to tumors, but is often noted in benign conditions, such as inflammatory processes, neuralgias, arthritis, *et cetera*. In his remarks Dr. Richardson<sup>1</sup> implied that psychology must have something to do with this. Psychology may or may not have something to do with the analgesic effect of the rays, but certainly it is not the major factor, and relief from pain is often obtained in cases in which psychology does not enter. For instance, extraction of teeth is often followed by an inflammatory reaction in the form of swelling around the jaw, which may continue from a few days to a week or more and may be accompanied by more or less pain. Irradiation of such inflammation causes it to subside very rapidly and the pain to disappear. Some patients with neuralgic manifestations in the lower extremities, with or without backache, can be given complete relief. The treatment is not uniformly effective, and this is undoubtedly due to uncertainty about the character and location of the etiologic factor in each case.

In connection with the mechanism of this analgesic property of roentgen rays in benign conditions, I have reviewed all the experimental and clinical evidence and cannot escape the conclusion that probably the major factor is the effect on lymphocytes infiltrating such lesions. Lymphocytic in-

<sup>1</sup>Not received for publication.

filtration is a common and sometimes the major feature of many inflammatory processes. It is also well known that lymphocytes are extremely sensitive to irradiation and that large numbers of these cells are destroyed very rapidly after exposure to the rays. Consequently, it is not surprising that many inflammatory deposits are rapidly and markedly influenced by irradiation and pain relieved by release from pressure of hyperplastic cells. So far as sciatic neuralgia is concerned, the effect of treatment depends entirely on whether the treatment is directed to the proper region. Unfortunately, it is not always easy to determine what is the proper region. The neuralgia may be due to inflammatory deposits around the paravertebral foramina or it may be due to an actual inflammation of the nerve itself. Some cases are greatly and rapidly relieved by treatment directed to the dorso-lumbar spine, while others are relieved only by irradiation of the sciatic nerve itself. In other words, the treatment must be directed to the lesion responsible for the pain. I mention this simply as a possible explanation for the lack of uniformity in the result of irradiation in such cases.

So far as the action of irradiation on furuncles and carbuncles is concerned, I undertook such work with considerable hesitation, because I questioned the advisability of destroying the lymphocytes infiltrating the involved region—fearing that such destruction might lead to extension of the inflammatory process or to other unfavorable complications. But such untoward developments never occurred. In trying to account for this I have formulated the following tentative explanation: The lymphocytes infiltrating such lesions contain within them the protective substances which serve to develop and confer immunity. Destruction of the lymphocytes by irradiation liberates these protective substances into the surrounding tissues, where they become mixed

with the other tissue fluids and therefore become even more readily diffusible and available for protection than if they had remained within the intact cells.

So far as dosage is concerned, I agree with Dr. Carter that heavy doses are not required, or indeed advisable. Rays generated at moderate voltage are preferable to those generated at high voltage for the treatment of benign conditions. Of course, when the treatment is directed against malignant tumors it must be adapted in quality and quantity to the particular tumor under treatment.

DR. W. L. ROSS (Omaha, Nebr.): I know that Dr. Carter is speaking the truth when he says that the X-ray will relieve pain. I want to add to his a few other instances in which I have found the X-ray serviceable in relieving pain, namely, mastoiditis, maxillary sinusitis, appendicitis, and salpingitis.

Dr. Henry Schmitz<sup>2</sup> in his discussion stated that it was dangerous to use the X-ray if there was any fluid in the abdominal cavity. Such has not been my experience, for I have repeatedly and successfully relieved the pain in pyosalpinx and carried the case through to complete recovery.

DR. CHARLES V. GENOWAY (Boise, Idaho): No one has mentioned the common earache of childhood. During the winter months, and especially with influenza infections, there are many cases of obstinate middle ear infection, with intense pain, that the specialists have much difficulty in subduing.

Remembering the analgesic properties of the X-ray, I tried out a few cases, with excellent results. During the past year I have treated quite a number. I use 125 K.V.,  $\frac{1}{4}$  copper, 1 aluminum filter, 18 inches distance, 5 ma., 10 minutes time. Repeat in

<sup>2</sup>Not received for publication.

seven days if necessary. The relief of pain is quite marked.

Pleurisy pains are also relieved.

DR. CARTER (closing): I do not know that I really have anything further to add—I have said about all I know in the paper. I wish to thank Dr. Richardson<sup>1</sup> for the very flattering remarks which he made in regard to the personal equation. This I do say, in agreement with him, that probably the personal factor has something to do with the results one gets. I make it a rule in all my practice that no patient shall receive a therapeutic treatment unless that treatment is personally originated and supervised by myself. I know exactly what the patient is given, and am consequently in a position to know something of the result.

Now I do not know that I can answer any of these very deep questions as to the cause of the analgesic effect. I agree with Dr. Desjardins that the result is produced very largely by the reduction of the lymphocytic infiltration. This is especially borne out by the fact that we get such relief in the treatment of nerve ganglia when compressed, such as an intercostal nerve in the intervertebral foramina, or the gasserian ganglion, which probably is depressed in its

fossa by the very tight membrane which overlies it. I believe also that there is probably, as suggested by Dr. Desjardins in his paper last year, some definite specific analgesic effect upon the nerve ganglia themselves.

I would emphasize what some of the other speakers have already stated, that to get relief from the pain of neuralgia, we must not treat the distribution of the nerve; that is, when the pain is of ganglionic origin—we must treat the ganglion on that nerve.

I agree with Dr. Schmitz<sup>2</sup> in his limitation of the treatment, in regard to the presence of pus. I do not think I have treated a serious case of tuberculous peritonitis, save following operation, without absolute determination having been made as to the presence or absence of pus pockets. You will notice that I said, in regard to the good results we get in pelvic inflammation, that we must first, by bimanual examination, eliminate any possible pus focus in the pelvic cavity.

As to the theory of the origin of this relief, whether it is in the nature of a deposit or of an absorptive process, all my study of the question seems to point to the absorptive power of the ray.

---

## THE BIOLOGICAL ASPECTS OF ROENTGEN THERAPY<sup>1</sup>

By PROF. DR. H. HOLTHUSEN, Allgemeines Krankenhaus St. Georg,  
HAMBURG, GERMANY

**I**F I may speak to-night on the effect of the rays on living matter, it will not, perhaps, be out of place to ask ourselves, first, how it is that the whole scale of electromagnetic waves forms a continuity—from the kilometer-long electric waves of wireless telegraphy down to the short waves of the cosmic radiation which reach us from the outer space—and that we react on certain limited wave lengths only. Out of this whole range of electromagnetic vibrations, which differ from each other only in frequency, there is but one single octave to which our eyes are susceptible as visible light of various colors. The neighboring field of longer waves is felt by us as heat. Our body reacts with severe inflammation of the skin on the neighboring short waves, which we designate as ultra-violet rays. Not a single cell of our body is able to withstand for any length of time the high frequency wave lengths represented by X-rays and  $\gamma$ -rays.

This resonance in the reaction of our body on certain wave lengths is more easily understood by us if we consider from the point of view of *energy* what takes place between the rays and living matter, if each reacts on the other. From the point of view of energy we have to look upon the rays as the *carriers of energy*, which is divided into separate amounts, called "quanta." Each separate quantum of radiation contains a very small amount of energy, depending upon the wave length. The quanta increase toward the short wave end of the spectrum in inverse ratio to the wave length. (Fig. 1.) The *amount of energy in a single quantum* is determined by the wave length. The *intensity* is given by its number. These

quanta owe their great effect to their high concentration of energy, so that, in spite of the absolutely small amount of energy of a single quantum, each of them is able to attack the molecules which it penetrates.

To-day we know that any changes in the status of molecules in the beginning of chemical processes, upon which biological effects of rays must be based, needs a certain quantum of energy for each single process. The amount of this energy depends upon the special structure of the molecules. Very fine resonance exists here. The amount of a quantum energy necessary in order to influence the molecules, appears to be of a magnitude which is not reached by the radiation quanta until they approach the limit of visible light, and especially the ultra-violet part. The idea of the construction of molecules leads us to expect a reaction of the molecules on a supply of energy by means of radiation in three forms:

1. *Chemical reactions*, meaning the re-grouping of the component atoms of the molecule;
2. *Radiation*, which we must look upon nowadays as the expression of a re-arrangement of electrons in the molecule, which is always connected with a loss of energy, and
3. *Separation of electrons* from the molecule, which shows itself to us as ionization, and, in general, as photo-electric effect.

And if we ask ourselves where these three effects begin, in the scale of wave length, we shall ascertain that it is in the range of the visible rays, although only in the case of separate molecules, and that the corresponding reactions are more and more numerous in the ultra-violet range.

As carriers of energy, all kinds of rays produce in the medium in which they are absorbed a rise of temperature which is in-

<sup>1</sup>Read before the Radiological Society of North America, at the Thirteenth Annual Meeting, at New Orleans, Dec. 2, 1927.

dependent of the magnitude of their quantum, but dependent upon their total energy absorbed. If the term "heat rays" is given to only a certain part of the entire scale of wave lengths, it is owing to the fact that the maximum of energy of the terrestrial sources of light always lies in that portion, *viz.*, the infra-red part. The biological effect is not dependent upon the situation of this maximum.

Ultra-violet rays and especially the X-rays owe their great biological effect to the magnitude of their single quanta. In the field of X-rays a single quantum is even 25,000 times greater than in the ultra-violet zone. Therefore, there is a great disproportion between this enormous quantum-energy and the energy capable of being absorbed by each single molecule. In consequence, by far the greater part of the energy of the X-rays passes over during the process of absorption to the photo-electrons, and these it is which, in their turn, give off their energy in partial amounts, together with a slowing-down of their speed, thereby producing, amongst others, biological reactions in the tissues.

At this point I should like to mention that, as we know to-day, the energy of the X-rays is absorbed, not only during the above described process, but also during the scattering process by the scattering molecule. The recoil-electrons carry also an amount of superfluous energy, exceeding more or less the capacity for absorption of the scattering molecules, according to the Compton law. The energy directly received by the absorbing molecule falls far behind the energy given to recoil- and photo-electrons; therefore, the X-ray effects are to be looked upon as the effect of *electronic radiation*—that is, of rays which have been produced here in America by Coolidge with a particular device in a greatly intensified form, and which, owing to their great concentration, have proved destructive to the tissues. In com-

paring the effects of the X-rays and of light, it is of the greatest importance that, in the case of light-rays, only the primary quanta of radiation are effective, whilst, on the other hand, in the case of X-rays, photo- and recoil-electrons are responsible for the biological effect.

Light supplies always distinct amounts of quantum energy. On the other hand, the electrons produced by the X-rays give off any amount of energy for absorption by the tissue molecules. In a word, this means: *specific* effect, *i.e.*, dependence of the effect on the wave length in the case of light; *un-specific* effect, which is an effect independent of the wave length in the case of X-rays.

Let us now make it clear to ourselves what biological effects are produced by light rays in the various parts of the spectrum. In doing so we may base our observations on the assumption that the biological effect of the rays consists, in reality, of a chemical change in the molecules which are struck by the rays, or, speaking in general terms, on a *radio-chemical effect*.

Up to the limit of the visible spectrum, *i.e.*, about 8,000 Å.U., the rays are effective only in so far as they produce a rise in temperature of the radiated layers. We are dealing with a molar absorption. The energy is communicated direct to the molecule as a whole in the form of a kinetic impulse, *i.e.*, it is transformed into *thermic motion*. The quanta do not suffice to excite the molecules by acting on the molecular electrons.

The artificial sources of light, such as flames, lamps, arc lights, etc., have their maximum of energy in the infra-red part of the spectrum. However, the thermic effect reaches far into the visible spectrum and decreases toward the short wave-end of the spectrum only because, in the sources of light at our disposal, the total radiated energy becomes less and less with decreasing wave length. It is in the case of the sun



only that the maximum of energy lies in the range of the visible rays. Here, therefore, the thermic effect is called forth chiefly by the visible rays.

The biological effect of the thermic radiation, although it has no specific chemical action, is not independent of the wave length.

rays than of visible light. The great absorption in the field of ultra-red rays results in its effect being concentrated in the uppermost epidermic layers, producing a rise in temperature which leads to irritation of the nerves of temperature and pain, at a time when comparatively a small part of the total

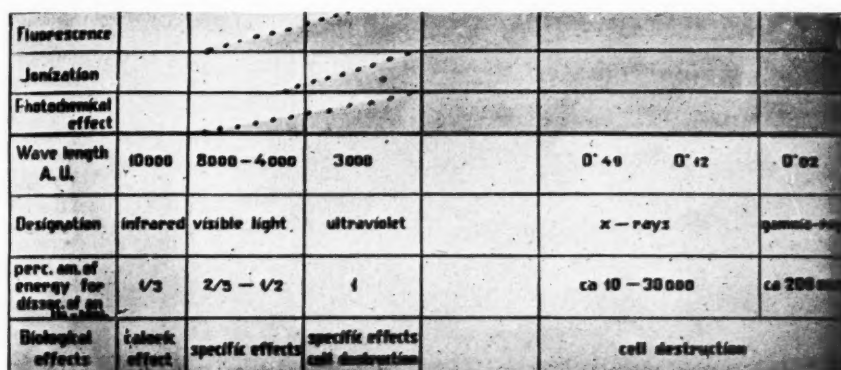


Fig. 1. Physical and biological effects dependent upon the wave length.

The absorption changes with the wave length according to a change in its penetrative power. We must always keep in mind in comparing an analysis of the biological effect of rays of various wave lengths that with the wave length the penetrative power of the rays changes and with it the distribution of its intensity in the radiated object. Many differences in the manifestation of the effects of radiation with various wave lengths are wrongly put down to variations in the effects of the rays, whilst in reality they are only due to changes in the distribution of intensity, depending on the kind of radiation. We shall come back to this in considering the course of the reaction of the skin with different qualities of rays.

As far as the thermic rays are concerned, they show the following: It was Rubner who demonstrated that the limit of tolerance for the absorption of thermic rays through the skin is lower in the case of ultra-red

energy has been absorbed. A larger amount of energy can on the whole be absorbed from the range of visible rays, with its greater penetrative power. If it is desired to conduct to the body as large an amount of heat as possible, by means of radiation, visible light should be given the preference. On the other hand, should an irritation of the skin be desired, then the infra-red rays had better be used. From a teleological point of view we must regard it as especially advantageous that the sun in its capacity as the source of heat for the organic world has its maximum of energy in visible light. The sun is at the same time a regulator for preventing an immoderate effect of heat in districts of very strong sunshine. It is the ultra-violet part of the solar spectrum, the thermic effect of which may be looked upon as negligible, which chiefly causes the pigmentation of the skin. This pigmentation, however, prevents the rays which are ab-

sorbed in the upper epidermic layers from penetrating too deeply. They excite perspiration and thereby increase the giving off of heat.

This provoking of pigmentation by the ultra-violet rays must be regarded as a *specific effect*, a photochemical action of the shorter part of the light spectrum, though unknown to us in the details of its chemical process. I must again stress that this reaction is first produced in the ultra-violet part of the spectrum, although by comparatively long waves of the ultra-violet zone. It is here noted that the introduction of chemical processes necessitates in general an amount of quantum energy which only begins to be reached in the ultra-violet zone. An exception exists alone in the case of two photobiologic processes, *i.e.*, eyesight and the carbohydrate synthesis of plants. For the latter reactions, certain supplementary conditions are present. Both reactions take place under the co-operation of certain fluorescent pigments, which act as sensibilizers, *i.e.*, the chlorophyl in the plants and the see-purple in the organs of sight.

Figure 1 shows a diagram of the most important known photobiological reactions corresponding to the zones of light by which they are produced. This specificity of the reaction, the marked resonance with certain parts of the spectrum, is distinctly shown in the chart, although not quite free from error, for the influence of any change in the penetrative power of the rays, with their frequency, which I might call their "penetrative effect," results in the dependence of the molecular sensibility on the wave length not being clearly shown.

For instance, the extension of the visible spectrum to the short-waved part is not limited by the cessation of sensibility of the specific elements of the retina, but by the impossibility for radiations with a wave length shorter than 4,000 Å.U. to penetrate to the

photosensitive part of the eye. The same is to be found with the erythema reaction of the skin under the influence of short-waved ultra-violet. Here the investigations of Hausser and Vahle have proved a sharp increase of the erythema effect with wave lengths of 3,100 Å.U., which is followed by a maximum of 2,900 and a decrease down to a minimum of 2,800 Å.U. A second maximum is to be found at 2,500 Å.U. Only the mounting part of the curve corresponds to the beginning of a destructive reaction of the rays. The decreasing branch and the minimum are the expression of an interference of the "penetrative effect," for the minimum is caused by an increase of the absorbability of the rays to such an extent that the rays are totally absorbed in the superficial skin layers, particularly in the horny layer, and do not penetrate into the susceptible layer, the stratum granulosum.

The absorption curve for albuminous substances, as has been measured recently by Kollath, is entirely opposed to Hausser's erythema curve in the decreasing branch. It has its maximum of absorption exactly where the erythema effect reaches its minimum, proving thereby that this minimum may be laid to the absorption of the rays in the superficial layers of the skin. Thereby this curve loses its fundamental character, for it is easily to be seen that it would turn out differently if the conditions of absorption in the skin were different; if, for instance, the absorbing superficial layers of the skin were not present.

Such an absorption curve of albumin has its characteristic feature, analogous to the absorption curve of the hemoglobin in the visible part of the spectrum. We may also say that the albumin is colored in the ultra-violet zone. It is interesting to note that under the influence of ultra-violet radiation albumin takes on a deeper color in the ultra-violet zone. Irradiated albumin becomes

more impenetrative for ultra-violet, and, also, radiated skin does not permit light to penetrate as easily as does normal skin. We may even say that by means of radiation the skin becomes pigmented not only in the zone of visibility, but also in the field of ultra-violet rays. A decrease of the transparency for ultra-violet rays is responsible for the fact that skin which has been previously radiated is afterwards less sensitive to light.

The pigmentation of the serum in the ultra-violet zone which is shown in absorption curves gained with the aid of a quartz spectrograph promises great diagnostic importance. We already have the first statements about characteristic changes of the ultra-violet spectrum in certain diseases. The possibilities which lie in the characteristic changes of ultra-violet absorption, brought about by chemical influence on a certain kind of albuminous bodies, need only be remembered.

In going back to our observations on the specific photobiologic effects, two most important discoveries must be kept in mind, which give quite new viewpoints on the part played by light in processes of growth. One relates to the well known discovery, made jointly by Windaus and Hess, that the influence of short wave lengths produces out of ergosterin a chemical body with antirachitic properties, which has not yet been characterized in detail but which is identical with the antirachitic vitamin D. The field of absorption for this reaction is sharply defined and has been found by Pohl, in Göttingen, to lie between 3000 and 2800 Å.U.

The second discovery deals with the co-operation of rays in the dividing of cells. Gurewitsch found that a tissue containing plenty of mitoses emits rays which in turn may produce mitoses on their part. I am sorry not to be able to go into more detail concerning the experiments leading to this most remarkable assumption. I should, however, like to state that Reither and Ga-

bor, in Berlin, have not only confirmed the presence of mitogenetic rays, but have also discovered that the effect results from particular rays in the neighborhood of 3370 Å.U. If the vegetative cone of an onion be treated with a certain quantity of rays of this wave length, the cellular division becomes more lively at the spot where the rays strike the root. Treated by these rays, tadpoles develop more rapidly. An overdose of the rays injures the cells. Even in the neighborhood of the effective wave length of about 3370, the rays lose their effect entirely. The mitogenetic rays comprising a strictly limited zone of wave lengths show a distinct type of specific radial effect.

Let us pass over the borderland between ultra-violet and X-rays, which has, up till now, been investigated very little. It is difficult to employ, in experimenting with biological objects, on account of the high absorbability, and will, therefore, not enter into this discussion. With regard to the field of X-rays, it is not possible to make a diagram showing the preferred effect of certain wave length zones in connection with biological reaction, as is shown in ultra-violet light. There is great monotony in the effect of different wave lengths in the field of X-rays. It may here be stated with considerable probability of truth that all the effects of rays which have been observed are absolutely independent of wave lengths. As has been explained, we have not to deal with effects of sharply defined quanta of rays, but with radiation quanta, the energy of which may be disposed of in any desired amount. Accordingly, the effect of the short wave rays on cells is unspecific. If the lymphocytes are particularly sensitive to X-rays, this shows only that these cells have, in general, great lability. We know that they are always sacrificed when their ferments or other effective component parts, set free by decomposition, are needed by the body.

The wide variation in the sensitiveness to X-rays in various kinds of cells, which has led to a misunderstanding regarding the electivity of the cells, exists equally for all qualities of cells. There is no change of electivity of the sensitiveness to rays in connection with the wave length, and where it has apparently been found observers have been deceived by the great influence of the above mentioned penetrative effect, meaning the change of the distribution of intensity in a radiated body owing to a change in the absorption coefficient with the voltage. The great difference in penetrative power between the softest and hardest therapeutically employed roentgen rays influences the distribution of intensity of the rays in the tissues and is of very considerable influence on the way in which the radial reaction is manifested. Let me give you an example of the reaction on the skin. It cannot be denied that the reaction of the skin takes an exceedingly different course in the supersoft roentgen rays used by Bucky and the hard filtered rays of deep therapy. In the case of very soft rays of a medium wave length of 5000 Å.U., we can multiply the dose, already producing a severe erythema, without essentially altering the type of reaction. If hard filtered rays were used, this increase in the dose would lead to the severest burns. It would seem at the first glance that there was a difference in the graduation of the effect of the X-rays, yet it is only proof of the fact that in the case of very soft roentgen rays the effect is limited to the topmost epidermic layers. Hard X-rays are absorbed almost in the same quantity in all epidermic layers. The increase of the dose in the cutis leads to an injury of the connective tissue cells and blood vessels, thus preventing the necessary nourishment of the radiated area of skin, and causing slough.

The difference in the distribution of the effective dose in the skin in the case of soft and hard X-rays explains also the difference

in the interval of time which must be allowed to elapse before the skin will have entirely recovered from the impact of the rays. If the epidermic layers themselves are chiefly affected, we have to deal with a tissue which is physiologically being rapidly regenerated and which, compared to the cells of the cuticle and the endothelial cells of the vessels, has an increased cycle of life. It is characteristic that the intervals of time which must elapse between two full dose radiations must be greater the more hard rays are placed at our disposal by technical means. The period of recovery lasting three weeks which was prescribed for the treatment by means of unfiltered rays has caused great disappointment, if also used after a full dose of hard filtered rays. The longer time of recovery of the tissues which has been observed in the skin after treatment with harder rays, is, therefore, not an essential characteristic of the corresponding rays, but is produced by the difference in penetration. The assumption of a uniformity of the biological action throughout the whole range of the X-rays greatly simplifies the answer to the question regarding the nature of the injuries. Our knowledge of the first changes caused by the rays is still very limited. We have, however, good reason for the opinion that the first attacks by the rays take place in the albumin molecules. This opinion would appear to be supported by the fact of the great similarity between injuries caused by rays and by heat.

Attention has repeatedly been drawn to this very extensive similarity between injuries through heat and radiation. I have compared the course taken by injuries of X-rays and heat in connection with *Ascaris* eggs, objects by which the influence of the X-rays may be very clearly studied. It was shown thereby that the way in which the injuries manifest themselves by peculiar malformation in the case of ray and heat injuries was the same. The difference in



sensitivity was shown by the eggs in various stages of maturity and of cell division, and various worms were present in the same characteristic manner after the eggs had been injured by heat and by irradiation. This can mean nothing else than that in both cases similar molecules were affected. Injury through heat shows one characteristic feature which may lead to conclusions being drawn as to the kind of component parts of the tissue in which the process of injury is taking place. Injury through heat has an unusually high temperature coefficient, of a degree which is characteristic for the caloric denaturalization of albumin. If the point of attack must be thought to be in the molecular albuminous compositions in the case of injury through heat, the same may be said about injuries through radiation. It has been known for some time that the short wave rays are capable of irreversibly denaturalizing albumin and of effecting its aggregation and coagulation. This denaturalization by the rays in the case of molecular albuminous bodies, and probably of lipoids, is very likely the *primary effect* of the rays. The primary impact denotes a loss of vitally important molecules, thereby impairing the cell. It is shown in all its parts in the nucleus, the protoplasm, and the membrane.

A description covering the whole radiopathology would have to be given if any illustration were to be offered as to how the ray disease of the cell manifests itself. The destruction of albuminous molecules by radiation means also the formation of pharmacologically effective disintegration products. The products of destruction arising from the disintegration of the high molecular bodies, whether they have been formed by means of a photolytic process or later in the course of a secondary following process, affect the cell in which they are formed. They affect their surroundings and the whole organism by entering into the circu-

lation. The circle of radial reactions responsible for the effect of the highly molecular disintegration products becomes more and more extensive. In the course of the last few years marked parallels have appeared between the general effects of the X-rays and the effects of the protein bodies. Common to both is a "*Umstimmung*" of the organism, which manifests itself in an alteration of the salt content of the tissues and the blood, in a "transmineralization" (Kroetz), in a transmutation of the albuminous bodies in the blood plasma, and in a number of other humoral and cellular blood changes, as is characteristic for the effect of high molecular albuminous products. We have reason to believe that the mechanism of the radial effects is the same in the case of inflammations of all kinds, in which it accepts radial treatment, *i.e.*, tuberculosis, gonorrhea, actinomycosis, as in the case of unspecified irritant therapeutics.

The impact of the rays, irreversible as far as the primary process is concerned, is repairable as a manifest injury within certain limits. It would seem as if the recovery from the radial impact is dependent upon counter-reactions which appear at once with the commencement of the radial injury and in favorable cases may lead to a complete repair of the cell. One presupposition therefor is the normal course of the vital processes. It is due to the influence of such counter-reactions that a tissue is the less injured by a certain dose, the longer its duration. A dose which, applied during half an hour, causes a severe erythema of the skin shows no visible reaction at all if distributed over three days. Something similar is shown in comparatively short periods of time. In the case of bean germs, differences in the effect of the same dose were to be seen according to whether it was given during one or ten minutes. There are apparently no recovering reactions in the conditions of anoxymbiosis. As long as *Ascaris*



eggs are kept under pyrogallol in an airtight vessel, meaning, therefore, in a deoxygenized atmosphere, complete cumulation of the partial doses appears. In the open air the distributed partial doses given during the development of the cells do not cumulate entirely.

The phenomenon of the incomplete cumulation of distributed doses, dependent upon the speed of the vital rhythm of the cells, meaning the magnitude of the cellular metabolism, or, in other words, the rapidity of the cell division, is of essential importance. It regulates the laws according to which the distribution of doses must take place in X-ray therapy.

An incomplete cumulation of distributed doses might also be expected, if the partial doses following the first radiation were to impact upon a radiated tissue in a condition of decreased sensitiveness; in other words, if the tissue became *allergic* by the radiation. The presence of hypoergy is presumed as a result of the observation of becoming accustomed to light. To-day we know that it is not a decrease of molecular sensitivity or a decrease of the sensitivity of the reactionary molecules, but an effect produced by a decrease of the absorbability of the skin for the ultra-violet rays, which causes a decrease of sensitivity of the skin for ultra-violet rays. For this reason nothing similar could be ascertained regarding X-rays, as their absorption is not altered by chemical changes of any kind in the albuminous bodies.

If we speak of pathologic tissues, especially tumors, becoming refractory after repeated radiation, and of pathologic cells becoming immune to radiation, this is nothing more than an external analogy, as it is actually unknown to us what takes place.

The question has often been brought up as to whether or not a tissue may be sensitized by a preceding partial radiation for succeeding radiation, *i.e.*, may be placed in

a hyperergical condition, and how the radiation has to be selected and distributed in order to gain this effect. It may be looked upon as certain that some effects of radiation may better be attained by a suitable distribution of the dose than by applying the whole dose at once. The pertinent discoveries by Régaud, Schinz, Slotopolsky, Alberti, Politzer, and Nather are not sufficient to warrant one in theorizing about the attainment of a true radial hyperergy. It is probable that the favorable effect of fractional radiations of animal tumors is connected with the lesser general intoxication through divided doses. Nevertheless, these observations, even if but few, are of great importance and show that by means of a suitable distribution of doses the biological effect of a certain physical dose may be increased.

We now come to the end of our brief excursion in the field of radial biology. In order to bring into harmony with each other some of the fundamental problems, we have discussed them without considering their importance to radial therapy. Naturally we meet such connections everywhere. Not until we are quite clear as to the fundamental phenomena of X-ray effects shall we be able to rise above an empirical point of view and arrive at a rational idea of radiotherapeutics.

In conclusion, let us cast a glance in the direction in which a further development and a perfection of the present methods of radiotherapy may be looked for on the basis of our actual subject. In the case of light rays, with their specific effects in certain wave length zones, therapeutic possibilities may be increased and perhaps multiplied by the qualitative choice of the rays, *i.e.*, by preferring suitable wave length zones which are in accordance with the specific effects of the rays. With regard to X-rays, one path of investigation must be to find out the qualities of rays most suit-

able for the treatment of certain diseases. As we see it at the present, it is not probable that there is any prospect of that. Greater, however, are the possibilities on the second path, which aims at bringing the time distribution and the absolute amount of the dose in accordance with the special circumstances of the various diseases. As far as X-rays are to be considered, we hope in this way to succeed in suiting more than heretofore the average results to the oftentimes splendid but unfortunately much too sporadic single successes.

## DISCUSSION

DR. EDWIN C. ERNST (St. Louis): This presentation by Dr. Holthusen has been most interesting and instructive, even though, superficially, the problem might seem unusually complicated. Dr. Burrows, Dr. Jorstad, and I have been studying the effects of hard rays in animal experiments, attempting to classify the various fundamental types of systemic reactions following X-ray therapy and thus help to determine the most practical and effective method of administering radiations under various conditions. Dr. Holthusen has emphasized the recovery effect of radiation when the treatments were given over a period of longer duration than by the large single dose method. In our experience we have observed that the relationship of a diet containing known vitamins and other food substances in the treatment of rats influenced their recovery, as well as the time interval and quantity of the radiations. Under the ordinary diet régime, these same animals would show comparatively more rapid retrogressive changes and earlier death than the special diet rats. In a broad way, we attempted to apply these observations in our daily routine treatment of cancer patients, and the systemic effects appeared to be less pronounced when a full

vitamin diet was given due consideration. All of the factors discussed by Dr. Holthusen must be given continued future study by those of us interested in X-ray therapy of malignancy.

DR. W. E. CHAMBERLAIN (San Francisco): I wish I could rise to this occasion and properly discuss Prof. Holthusen's paper.

The last point which he made has impressed me as a very brief and accurate description of the present situation in respect to the radiation therapy of neoplasms. He said that our successes, when they occur, are so impressive that we do not know just where to look for a correction of the unfortunate failures. Apparently a great many factors are involved, many of which are hidden from us. Once in a while several of these factors happen to be in the same direction at the same moment, and we get a "success."

Prof. Holthusen's studies with respect to measuring X-rays by ionization in air are of the greatest interest to us. He reports *biologic effect parallel to ionization in air*. This is in complete agreement with our own work, and with what appears to me to be the final and complete proof, reported by Doctor Francis Carter Wood. All of this work indicates that a unit of X-ray measurement based upon ionization in air has the same significance from the standpoint of biologic effect, whether the X-ray involved is hard or soft. We can now, once and for all, lay the ghost of "changing the unit of dosage for each change in wave length." Whether or not 500 R with different wave lengths means the same amount of energy is not the question. From the standpoint of therapy the thing that counts is the fact that it means the same biologic effect.

DR. FRANCIS CARTER WOOD (New York City): The one point raised by Prof.

Holthusen has been, to a certain extent, answered by some experiments which were done in my laboratory some years ago, on the effect of repeated radiation on tumors. A mouse tumor or a rat tumor was rayed with 90 per cent of the dose required to kill it. It was then planted in a fresh animal, allowed to grow, and the morphology was studied. It was then given another 90 per cent dose, re-injected into a fresh series of animals, and this process was repeated for a long time. I was trying to find out whether a resistant strain of tumor cells could be selected by such a procedure, or whether a real immunity could be obtained, but at the end of the experiment the tumor cells were killed with exactly the same dose as the one with which we started. In other words, we were unable, by exposure to X-ray, to alter the biological quality of the tumor, at least as expressed by its killing dose with X-ray; nor were we able to produce any permanent morphological changes in those tumors, while, of course, as you all know, after such radiation nuclear changes of all varieties are found in the cells. Those changes ultimately disappeared in the tumors remaining in the animal, until, after a week or two or three weeks, dependent on the type of tumor and amount of radiation,

all these peculiar morphological alterations in the cells had disappeared and the tumor could not be distinguished from one which had never been rayed. Therefore, complete recovery can take place when a lethal dose is not given.

DR. H. HOLTHUSEN (closing): I wish to ask Dr. Wood one question. I am very much interested in his results and I dare say that my experiments with bacteria came to the same conclusion, but I know that there are some experiments done by Russ, and I should like to ask Dr. Wood whether he knows of them and what he really thinks of them.

DR. F. C. WOOD: I am quite familiar with Russ' experiments. We do not agree at all on the results. I suggest that he repeat his experiments under the same conditions we did. If the tumor is rayed in the animal and left there, then the vascular and other changes in the connective tissue and skin of the animal may play a part, but our experiment is to take the tumor out and give it a chance to grow again in a healthy animal. Russ and I do not yet agree on the results. I think he will finally find that he is wrong and that we are right.

---

## COMPARATIVE NOTES ON RADON IMPLANTS

By ALBERT SOILAND, M.D., WILLIAM E. COSTOLOW, M.D., and

ORVILLE N. MELAND, M.D., LOS ANGELES, CALIF.

THE present trend of radium therapy shows a divergence into two widely separated lines of endeavor. The first is the skillfully prepared and ingeniously contained radium implants, making possible the accurate introduction of a definite amount of radium emanation or radon into or in contact with an active neoplastic area. The second is the collection of radium salts in quantities large enough to permit of long range radiation similar to but productive of more gamma radiation than that of the present high voltage X-ray generator.

The purpose of this paper is to consider some of the problems which confront the radiologist in his routine work, as well as the conditions which call forth the first-named type, the radium "seed," or implant.

The primary requirement is that one should be cognizant of the fact that he is in control of a very small but exceedingly potent agent which necessitates not only a comprehensive knowledge of radiology but also that skill which a well-balanced medical man must possess in all branches which enter into the successful diagnosis and treatment of neoplastic disease. This statement appears superfluous, but when one realizes that these potent radium seeds can be purchased by anyone, and that they not infrequently fall into the hands of those not qualified either by experience or training to use them, the need for caution is apparent. In this manner an agent which is extremely valuable to the trained radiologist may occasion much abuse and adverse criticism, if permitted to run amuck without proper supervision.

Glass radon implants have been used for several years with remarkable success in many cases, and with disastrous results in others. Since the advent of platinum and

gold filtered points, it is doubtful if the demand for glass tubes will continue much longer. The writers have entirely discontinued the use of glass implants, although in the past many good results have been obtained from the use of them in their clinic. This is especially true in tongue malignancy, where the blood supply is good and the tissue repair of the necrotic primary beta radiation effects more prompt and certain. Probably the great advantage of the filtered implant is due to the fact that a sufficient amount of radium is used to radiate thoroughly the periphery of the lesion, and at the same time serious local necrosis is avoided by the metallic filtration.

Correct estimation of the size of the growth is undoubtedly the most important factor in the consideration of the use of radon implants. The work of Quick, Failla, Quimby, Cutler and others, at the Memorial Hospital, has practically solved the dosage problem. Reference to their charts and hypothetical models will guide the operator so that he may remain well within the safety zone of dosage. The previous or older method of using one millicurie per cubic centimeter of malignant tissue, and spacing the tubes one centimeter apart, often caused either overdosage or underdosage. However, even with the most accurately calculated dosage and spacing of the implants, it is not always possible to obtain the desired result, as certain factors are difficult to overcome. The radiosensitivity of the tumor probably determines to a great extent the subsequent reaction and ultimate outcome.

Mechanically, it is often impossible to obtain an even distribution of the points throughout the malignant tissue. Overlapping of the necrotic areas of the implants should be avoided. Proper spacing is of

more importance than the total amount of radon used, especially in the use of filtered radon. Even with the filtered tubes, we have seen in a few cases the development of sloughs, due, probably, to the fact that the tubes were placed too close to the surface or too close to some bony structure, such as the periosteum of the jaw in one of our own cases.

The question of choice between the buried gold implants and the removable platinum points is rather difficult to decide. In inaccessible areas, the method of choice is certainly that of the gold implants. However, we are inclined to favor the removable implants in the mouth and in other accessible anatomical locations. Infection or complications very seldom develop from use of the removable points if they are withdrawn within a ten-day period. We saw one patient develop quite an extensive infection, with sloughing in the floor of the mouth, because the platinum point remained six weeks *in situ*, the patient having refused to have it removed. In most cases where the gold implants are used and allowed to remain indefinitely in the tissues, it seems that very little future trouble ensues. There is always a possibility, however, that a later reaction and slough may develop around the buried seed, due, possibly, to some trauma to the area. We have observed a few such cases, and consequently believe it better to use the removable seed, if this is just as convenient and the area just as accessible for later removal.

In all implant work the possibility of future late reactions must be borne in mind. The local action of the radiation on the blood supply of the area treated may cause later trouble. For some time we observed one tongue case that had been treated with implants four years previously. The malignancy had disappeared and the tongue seemed perfectly normal. Suddenly the patient developed a painful inflammation in the

tongue, with sloughing of a large area of tissue, apparently the area that had previously been surrounded by implants.

Regardless of an occasional case like the one mentioned above, the good results from implants far overshadow the bad results. In our recent series of ten tongue malignancies treated by implants, there was complete disappearance of the local malignancy in all but one. We believe that in these cases the local malignancy in the tongue was controlled more easily and with much better ultimate results than could have been done by electrocoagulation or surgery. The metallic implants seem almost ideal in the tongue, floor of the mouth, and the inner surface of the cheek. In lesions of the palate, however, we believe a better ultimate result will be obtained by electrocoagulation. In malignant lesions of the floor of the mouth and throat, radium implants are unquestionably superior to any other type of radium application.

In bladder malignancies, filtered implants appear to be the best form of radium therapy. In small lesions, the implants may be applied directly to the lesion through a cystoscopic applicator, but as the extent of the bladder lesion may be difficult to determine, or it may be multiple, suprapubic cystotomy with implantation alone, or combined with electrocoagulation, is probably the method of choice.

Rectal malignancy, which has always been a very difficult problem for radium therapy, will undoubtedly respond better to metallic implants applied directly to the lesion through the proctoscope than to any other method of treatment. In the smaller lesions in the lower rectum, the application may be made as accurately and easily as in superficial lesions elsewhere. We do not use radon implants in malignancies of the vulvæ. In these lesions we believe that electrocoagulation, followed by filtered radium packs at a distance, produces the best results with the



least discomfort to the patient. In primary malignancy of the vagina, the danger of fistula has caused us to use filtered surface radium applications either alone or combined with electrocoagulation.

We have used radon seeds in malignancy of the cervix in only a few cases, believing that this condition can be treated more safely, and with less chance of bladder and rectal injury, by using the ordinary brass filtered tubes, as advocated by most radiologists. The usual technic will take care of the local lesion satisfactorily, if the case is suitable for radiation at all, and there will not be the added danger of the implantation sequelæ. However, the treatment of pelvic gland metastases by the direct implantation of metallic seeds may prove an advantageous field for radium, although sufficient work has not yet been done anywhere to definitely establish the value of this procedure over the present methods. Naturally, the implantation into metastatic pelvic glands is a very tedious and difficult procedure on account of the widespread lymphatic distribution. In certain localized areas of gland metastases, however, this technic may be used to advantage.

In the face of much adverse criticism, the writers call attention to the altogether too prevalent use of radium implants by general practitioners, urologists, gynecologists, and laryngologists in cases which require the best skill and knowledge of trained radiologists. This is one of the outstanding reasons for the confusion and controversies of which radiation therapy is the storm center.

We are in touch almost daily with patients whose condition reflects disastrously their contact with amateur radium treatment. It is, of course, impossible to prevent any legalized practitioner of medicine and surgery from using any agent obtainable for the treatment of disease, but when a practitioner, for the sake of an additional fee, inserts powerful agents into human tissue—agents of whose strength and action he has only fragmentary knowledge—he is then not practising that kind of medicine which the interest of the patient demands. It is not intended by this statement to convey the idea that all radiologists can, with the ease implied by the literature of radium distributors, make accurate insertions of radon seeds into bladder neoplasms through the cystoscope, or into thoracic lesions through the bronchoscope. Far from it! In all such cases the combined skill of the surgeon and the radiologist must be correlated in order that the patient may obtain the best end-result possible at the present state of knowledge.

In conclusion, we are convinced from an experience dating back to the time when radium implants were first introduced that they cannot be used quite as easily and advantageously as the literature from various commercial firms would lead one to believe. They are, however, of great value if used properly in conjunction with other types of radiation therapy, and constitute, by virtue of their small size and flexibility, a medical agent of precision second to none other in the world.

## MALIGNANCY OF GASTRIC ULCER<sup>1</sup>

By LEWIS GREGORY COLE, M.D., NEW YORK

THERE has been much controversial discussion concerning the frequency with which benign gastric ulcers become malignant. It has been stated that this discussion has developed more heat than light, that the evidence submitted may be interpreted pro and con, depending on the bias of the investigator, and that it is an academic question unworthy of the interest that has been centered around it. Perhaps, in itself, it is.

My interest in this subject was stimulated by a scene that occurred in my office eight years ago. A young woman whose mother was dying of cancer and whose father had a post-pyloric (duodenal) ulcer wept because the surgeon to whom the X-ray report had been sent had told her that her father had an ulcer, and that Dr. Mayo said that 68 per cent of ulcers became malignant, therefore it should be operated on immediately, so that her father should not meet the untimely fate of her mother. This was of more than academic interest to her.

As a result of this scene and an invitation which came the same day to present a paper before the Gastro-enterological Section of the American Medical Association, I assembled the evidence of my own personal cases and prepared a communication—a résumé of which was read before that section of the American Medical Association. Both the résumé and the original article were refused publication in the *Journal of the American Medical Association*.

I then acknowledged, and still do, that there are gastric lesions which from X-ray evidence cannot be determined to be definitely benign or definitely malignant. These, however, form less than 10 per cent of gastric ulcers, less than 5 per cent of the organic

lesions, and much less than 1 per cent of the cases examined. The surgeon by inspection and palpation at an exploratory laparotomy cannot differentiate the malignant from the non-malignant lesions with a greater degree of accuracy than this, and the pathologists, in a large percentage of these borderline cases, differ radically, particularly as to the criteria on which they base their opinions.

The original American Medical Association article resulted in my being asked to participate in a symposium on Gastric Ulcer before the annual meeting of the Railroad Surgeons of America in 1920. Dr. Charles Mayo, Dr. Peck, Dr. Deaver, and myself discussed various phases of this subject, and at that meeting Dr. Mayo stated that he never claimed that 68 per cent of *all* gastric ulcers were or became malignant, but that 68 per cent of those ulcers *only* whose crater was more than 2 cm. in diameter, or "approximately the size of a quarter," were or became malignant. In my own experience, less than 10 per cent of the cases of gastric ulcer had craters of this size. Thus, according to Dr. Mayo's own statement, there were only 68 per cent of 10 per cent, or 6.8 per cent, of all gastric ulcers that were or might become malignant, and less than 3.5 per cent of all organic gastric lesions. This statement corresponded almost exactly with my own observations, which were that 60 per cent of those doubtful cases were malignant and 40 per cent were benign, but, we must reiterate, that it was 60 per cent of the *doubtful* cases (that is, 60 per cent of 10 per cent) and not 60 per cent of *all* gastric ulcers, that were or became malignant.

With this thorough understanding of each other's conception of this relatively small percentage of gastric ulcers that were or became malignant, Dr. Mayo said they "would put the soft pedal on the malignancy of

<sup>1</sup>Read before the Radiological Society of North America, at the Thirteenth Annual Meeting, at New Orleans, Nov. 28-Dec. 2, 1927.

gastric ulcers." And so they did, for six or seven years. In January, 1927, the pedal slipped and piped forth the note that "every gastric ulcer should be considered a potential cancer."<sup>2</sup>

Having come to the understanding with the Mayo Clinic, I allowed the original article on the subject of gastric ulcer to lie dormant for seven years of silence, but with the silence broken by the new blast of the trumpet, the day of resurrection is at hand, and as the article which I presented before the American Medical Association meeting then expressed my conviction, and still expresses it better than any statements that I can compose, it is now presented as part of this communication, with the hope that it may convey my convictions of to-day and yesterday.

DO GASTRIC ULCERS FREQUENTLY BECOME MALIGNANT?<sup>3</sup>

Opinions vary on this from A to Z: from Aschoff, who believes that they never do, to Zenker, who believes that all gastric cancers originate from a previous benign ulcer. Dr. Charles Mayo stated that Moynihan, Wilson, and MacCarty consider that the development of a cancer on the site of an ulcer is very frequent, and he added that the opinion of a postmortem or dead pathologist has no such value as that of a live clinical pathologist. I believe that the opinion of a "dead or postmortem pathologist," like Ewing, whose bread is not buttered on either side, is less likely to be biased than that of any live clinical pathologist associated with a surgical group. It makes not a whit of difference to me whether the patient is treated medically or surgically; in either case a post-operative or post-medical X-ray examination should be made, to show whether the ulcer has or has not

healed. The surgeon has no more right than the medical man to claim a cure without proving it.

The various opinions as to the percentage of gastric ulcers that become malignant are deduced from the following lines of evidence:

1. Clinical history of previous prolonged gastric symptoms.
2. Operative gastric ulcers that have become malignant.
3. The similarity of gastric cancer and gastric ulcer to cancer and ulcer in other parts of the body.
4. Microscopical findings.

*A clinical history of previous prolonged or intermittent symptoms* in cases proven to have gastric carcinoma is the first line of evidence submitted. Smithers, in Ochsner's "Surgical Diagnosis," says that 65 per cent of 921 cases of proven gastric cancer had a long dyspeptic course, apparently of benign type, preceding that which subsequently was clinically malignant, but he lays stress upon the statement that this does not establish the fact that a like proportion of benign gastric ulcers eventually terminate as cancers.

Mayo says that in more than 40 per cent of gastric cancers there is a history of ulcer, varying from many months to several years before the onset of the cancer.

Deaver states that 38 per cent of 100 gastric cancers, proven by the criteria chosen by Ewing, gave a history of repeated attacks of gastric symptoms and then finally one attack which grew steadily worse and terminated at the operating table. This line of evidence seems to me the weakest of all.

Gastric cancer comes like a thief in the night and gets a grip on the vitals of its victim without causing sufficient symptoms to lead the patient to consult his physician. This is evidenced by the fact that fully 50 per cent of gastric cancers reach a stage at which they are inoperable before they give

<sup>2</sup>Eusterman, George B., and Bueermann, Winfred H.: Carcinoma of the Stomach: Present Status of Diagnosis and Prognosis. Jour. Am. Med. Assn., Jan. 29, 1927, LXXXVII, 295.

<sup>3</sup>This is the title of the paper read before the American Medical Association, 1920, by the writer.

sufficient symptoms to warrant an X-ray examination, and many of the persons having such cancers have not even consulted a physician.

Moynihan says that the diagnosis of gastric ulcer cannot be made in 50 per cent of the cases by all clinical methods combined.

The clinical history of gastric ulcer and that of pylorospasm or hyperhydrochloria are so similar that it is absolutely absurd to undertake to differentiate them from each other by clinical symptoms.

If these statements are correct, and we have absolute evidence to prove that they are, I ask you, of what value are statistics based on such indefinite evidence as a clinical history of repeated attacks of gastric symptoms being proof of the presence of a gastric ulcer? This line of evidence is too weak to warrant the waste of time to refute it.

The second line of evidence submitted is that of *gastric ulcers that have developed cancer subsequent to operation*.

Mayo quotes v. Eiselberg as stating that 10 per cent of his gastric ulcer patients subsequently died of gastric cancer, and later analyzes his statistics to prove that 32 per cent of all deaths following operation for gastric ulcer were from gastric cancer. And he further states that recent data from Page, Perthings, Kittrum and others show the same results.

This seems like a strange line of evidence to submit as justification for surgical procedure in benign gastric ulcer. If this 32 per cent of all cases was proven non-malignant by microscopical examination and subsequently developed gastric cancer, may one not ask what part the surgical procedure has played in the development of the gastric cancer? Has not the oft-referred-to functional change in gastric digestion, which surgeons try to obtain by gastro-enterostomy, played some part in this high percentage of gastric cancers developing in the

stomach, not necessarily on the edge of the ulcer? Or has not the trauma incident to the application of the gastro-enterostomy clamp or the surgical manipulation played a part similar to that of trauma to the breast in mammary cancer?

If the non-malignancy of this 32 per cent of cases was not established by microscopical examination based on accepted criteria in all cases, then those cases that were malignant and not recognized as such at the time of the operation must be deducted from this percentage.

One frequently hears the statement, "*Gastric cancers develop on the edge or base of an ulcer, the same as in other parts of the body.*" Yes, just the same as an ulcer of the breast precedes a cancer of the breast, or an ulcer of the lip precedes a cancer of the lip, or an ulcer of the tongue precedes a cancer of the tongue. It practically never does, in the sense of an ulcer that is macroscopical and capable of removal by surgical procedure to prevent its developing into cancer. Who ever heard of the surgical removal of an ulcer of the breast to prevent its becoming malignant? The cancer of the breast is a cancer from the start but may ulcerate late or early in its career. The cancer of the lip is a cancer from the start but may ulcerate late or early. The cancer of the tongue is a cancer from the start but may ulcerate late or early. So with the gastric cancer; a gastric cancer is cancer from the start but may ulcerate late or early.

The fourth line of evidence submitted is *the microscopical evidence of malignancy engrafted on the edge or base of a non-malignant ulcer*. MacCarty, before the American Roentgen Ray Society, in 1916, in an article entitled, "The Legitimate Error on X-ray Diagnosis of Gastric Carcinoma and Ulcer," ridiculed the effort to make a differential diagnosis between gastric cancer and gastric ulcer on the X-ray evidence.



He further stated that it was impossible by inspection, palpation, and even by the ordinary microscopical examination, to determine whether or not malignancy was engrafted on the edge of an ulcer, and intimated that it was much more difficult to do so on the X-ray findings.

MacCarty also stated that the earliest recognizable changes in the cells are visible only under the highest power of the microscope, and stated (but did not publish this) that only a pathologist who was especially trained could by the use of some particularly high power microscope detect these changes in the arrangement of the cells or in the cells themselves. And it was on such evidence as this that the Mayo Clinic reported that 68 per cent of these gastric ulcers were complicated with gastric cancer. These same 68 per cent of gastric ulcers were on this evidence diagnosed as gastric cancer.

Just prior to this time<sup>4</sup> Dr. W. J. Mayo presented a paper before the American Medical Association on the operative treatment of gastric cancer, in which he stated that there was a prospect of 38 per cent three-year cures and 25 per cent five-year cures.

The criterion on which MacCarty made the diagnosis of cancer on the edge of a gastric ulcer comes under the barrage fire of some of the "dead or postmortem pathologists," and if one is interested in this aspect he should consult Ewing or Mallory. Under this barrage the high power pathologists have admitted that they have no microscopical evidence to prove that even a single case of gastric ulcer has become malignant. Yet the damage has been done, or, from their side, they have accomplished their end. So long as they operate, just so long will patients having benign gastric ulcers present themselves for the radical operation of subtotal gastrectomy, with high mortality, to prevent an ulcer from possibly becoming malignant.

<sup>4</sup>In 1918.

It has been published that 68 per cent of gastric ulcers become malignant, with the result that a certain scene is enacted in the surgeon's office, time and again, a scene so familiar that it will not be described in detail—you all know it too well! The net result of it is that the patient submits to an operation, being told that the Mayo Clinic says 68 per cent of all gastric ulcers become malignant. The surgeon himself does not assume the responsibility for the accuracy of this statement, but it carries all the more weight because of its source. If it were indeed true that 68 per cent of gastric ulcers become malignant, such a radical procedure might be justified; but if it is not true, if only 2 or 3 per cent of the patients who have had gastric ulcers some time in their lives develop cancer, this is not nearly so large a percentage as would die from the immediate results of a subtotal gastrectomy in the routine of surgery. Nor does it compare with the 32 per cent of proven gastric ulcers that were operated on and subsequently developed gastric cancer.

The vital question is, therefore, *What percentage of true benign gastric ulcers become malignant?* If we have been destructive in our criticism and are not willing to accept the evidence submitted in favor of 68 per cent, what have we to offer in its place?

We have a method of studying the natural history of gastric ulcers.

This, the most accurate method of determining if gastric ulcers ever become malignant, and if so, the frequency of such a development, is the study of the life history of the gastric ulcer under X-ray observation, and the following up of the patients for years afterward in order to determine what proportion of them die of gastric cancer.<sup>5</sup>

Seven years have elapsed since the writing of this, the original article on the subject,

<sup>5</sup>This is the end of the paper read by the writer in 1920.



and I now wish to present the following evidence for my conviction that gastric ulcers rarely become malignant. Let us observe a film showing in rapid succession a large number of gastric lesions—cancers, ulcers, and cases of doubtful malignancy.

From even a casual observation of these roentgenograms it is evident that the differential diagnosis between cancer and ulcer is so simple that in more than 90 per cent of the cases it could be made with a momentary glance at the roentgenogram. There are, however, ten or eleven cases, representing less than 10 per cent of all, in which an erroneous diagnosis has been made, or in which the X-ray findings do not, in the opinion of the writer, justify one in making a definite differentiation between cancer and ulcer, solely on the available roentgenologic evidence. A brief summary of these cases follows:

No. 1, first examined in March, 1914, has an hour-glass constriction of the corpus with wide sulcus between the upper and lower pouches, and a large crater. The patient was operated on by Dr. Brewer, a gastro-enterostomy being done. The question of malignancy was not settled before the patient went to England, so that the subsequent history of the case is unknown.

No. 2, first examined in November, 1915, was examined four or five times during a period of about three years. An ulcer of moderate size on the corpus was observed to diminish in size but never to disappear completely. After about three years a gastro-enterostomy was performed but the question of malignancy was not established. Shortly after this the patient developed a carcinoma of the stomach above the region where the ulcer had been observed, and died of a general carcinomatosis. The remaining crater had not altered in size or shape. It was only after the trauma of gastro-enterostomy that this patient developed a carcinoma adjacent to the ulcer.

No. 3, first examined in November, 1925, had a large indurated area on the lesser curvature close to the esophageal orifice, with cicatricial contraction involving the greater curvature. These findings were such that one was not justified in making definite differential diagnosis between cancer and ulcer. Three of the men associated with me considered the case to be malignant, but one of them and myself, if we had been pinned down to a single positive statement, would have said that it was non-malignant. The patient improved markedly for about six months, and then rapidly developed gastrointestinal symptoms. Subsequent roentgenograms showed a large indurated mass involving the lesser curvature of the stomach. The patient died of general carcinomatosis. This case might possibly be considered the second in which I made a positive diagnosis of ulcer, after which the patient died of carcinoma, but the case falls definitely into the group of large indurated ulcers concerning which, as I stated in the opening paragraphs, one is not justified in making a positive differential diagnosis.

No. 4, first examined in June, 1925, had a large ulcer, partial hour-glass constriction, with much induration high up on the greater curvature of the corpus. During my absence from the office this case was interpreted as a malignancy. On my return my opinion was that it was not malignant, but, considering its location and the large amount of induration, I am including it among the doubtful cases. Subsequent roentgenographic examination and the clinical history of the case over two and a half years' observation indicated that the lesion healed and therefore was not malignant.

No. 5, first examined in January, 1925, had a large area of induration on the greater curvature of the stomach projecting into the lumen of the stomach, and had all the characteristics of malignancy, yet I person-

ally interpreted this as a non-malignant indurated ulcer. The patient improved for several months and therefore did not return for a subsequent examination until a year afterwards, at which time there was an

fact, it was a case of very early infiltrating carcinoma that had not caused the lesser curvature to be sufficiently indurated to prevent some pliability. This error was more excusable than that made in Case No. 5, but

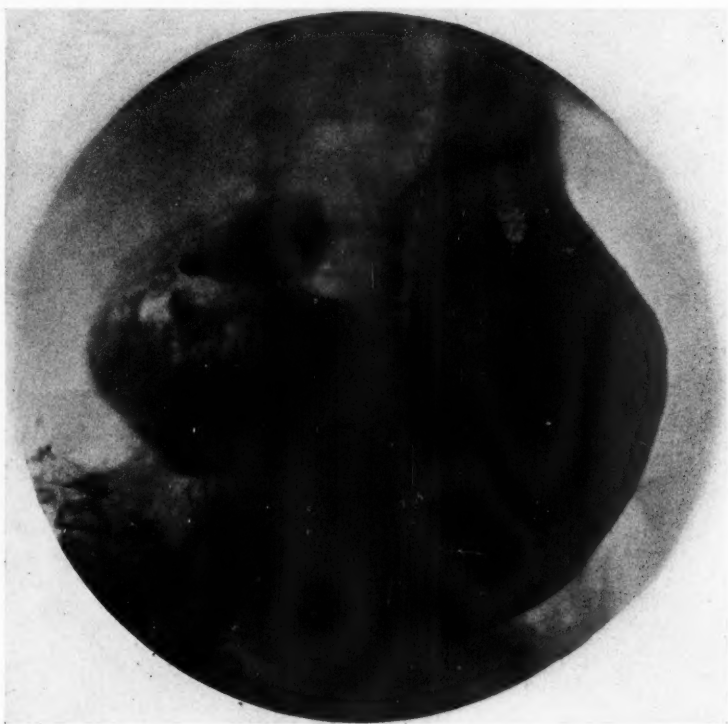


Fig. 1, Case No. 5. Newgrowth on greater curvature near pylorus, with an ulcerated area in the center.

inoperable carcinoma of the stomach. This was a straight out-and-out error in interpretation, and, with the evidence at hand, this error was inexcusable.

No. 6, first examined in August, 1926, showed a lack of pliability along the lesser curvature over an area of about two inches. This was present in all the plates but because of pliability in this local region, and because of the fact that the plates did not absolutely match over each other, I was led to consider this to be a case of multiple superficial erosions, when, as a matter of

nevertheless the experience gained from that case should prevent one from making such an erroneous diagnosis in future. Roentgenograms made in June, 1927, led to a positive diagnosis of carcinoma of the lesser curvature.

No. 7, first examined in April, 1924, had a large indurated ulcer involving the lesser curvature of the stomach. This patient had been operated on previously, an ulcer of the lesser curvature having been excised. The ulcer was considered to be non-malignant, but no microscopical examination of the

section had been made. It promptly recurred, with a large area of induration. A subtotal gastric resection was performed, and a pathological examination by six pathologists pronounced it sarcoma. Ewing

after a recurrence would indicate that the pathologic diagnosis of sarcoma or carcinoma was probably erroneous.

In Case No. 8, first examined in December, 1926, we made a tentative diagnosis of



Fig. 2, Case No. 6. Ulcerating carcinoma of stomach. At this time we made a diagnosis of simple multiple mucosal ulceration.

diagnosed it as embryonal carcinoma, and Pappenheim confirmed this opinion. The growth presently recurred, causing a stenosis of the stroma, and an anterior gastroenterostomy was performed. Four or five short X-ray treatments with 140,000 volts were administered, largely to please the patient. Subsequent to this the patient recovered, and now, four years later, is healthy. Our original equivocal diagnosis of ulcer or carcinoma was evidently justified, as the clinical history of four-year cure

malignancy, but advised examination to be repeated within three weeks. Owing to the illness of the doctor who referred this case to us the report never reached the patient, and not until two months later did he return for another examination. The process had not increased, but the ulcer was still present and therefore surgical procedure was recommended. Poole operated on the case and his operative diagnosis was malignancy. The pathologic report on the microscopic slides by Denton was non-ma-

lignancy. Subsequently this case was reported by another pathologist as sarcoma. One year later the patient reports himself well and free from symptoms. The equivocal X-ray diagnosis was justified by diver-

the crater was increasing or diminishing in size, and during this time it increased slightly. A pylorotomy was accordingly performed and a large indurated ulcer with greatly thickened edges protruding into the



Fig. 3, Case No. 7. Large crater on the lesser curvature surrounded by extensive induration. The indentation in the base of the crater is caused by a blood vessel.

gent pathologic reports from carefully made microscopic slides.

No. 9, first examined in October, 1926, had a large indurated ulcer on the greater curvature surface of the antrum. This ulcer caused a very extensive deformity of the entire antrum and a diagnosis of carcinoma was made by all of my associates. I advised waiting ten days to determine whether

lumen of the stomach was observed. The first microscopic examination reported this as benign but more extensive examination showed evidences of malignancy, both in the thickened indurated area and at the base of the ulcer. The therapeutic test of watching this ulcer for ten days to determine whether it was increasing or diminishing in size may or may not have been justified.

No. 10, first examined in August, 1926, had an annular constriction of the pyloric end of the stomach, diagnosed as a definite organic lesion, probably malignant. The case was operated on, the gall bladder and

examination we made a diagnosis of indurated ulcer, probably not malignant. Surgical exploration revealed a small indurated area in the pyloric antrum; no opinion could be rendered as to whether it was malignant



Fig. 4, Case No. 9. Carcinoma on the greater curvature in the region of the antrum, with a large area of ulceration. Note the similarity between Figures 1 and 4.

a gallstone being removed, but no report was made concerning the surgical findings at the pyloric end of the stomach. The patient's symptoms continued, and about a year later another X-ray examination was made, at which time the findings were almost identical with the first. At the second

or non-malignant. The specimen after a pylorotomy had been performed was suggestive of malignancy, but microscopic evidence proved it otherwise. Space does not permit of the detailed study of this case which I had intended to give.

A summary of these ten cases indicates



that in those cases where it is difficult to make a differential diagnosis between malignancy and non-malignancy on the basis of the X-ray findings, it is equally difficult to make a differential diagnosis on the surgical exploration. In two cases (Nos. 5 and 6), there was a definitely erroneous X-ray diagnosis for which there was no legitimate excuse. In Case No. 1 there was equivocal X-ray diagnosis and equivocal surgical diagnosis, with no specimen taken. In Case No. 2 there was a positive X-ray diagnosis of non-malignancy. After repeated examinations over three years a gastro-enterostomy was performed, after which the question of malignancy was not established, but subsequent to the surgical procedure the patient developed carcinoma of the stomach. Question: Did the surgical procedure help or hinder the progress of this case? Case No. 3 was considered as malignant by most of my associates and as non-malignant by myself, the patient later dying of malignancy. Case No. 4 is included in this group because I assume the responsibility for the diagnoses of my associates. No. 5 was one of out-and-out erroneous diagnosis without excuse. Case No. 6 was also one of erroneous diagnosis but with some excuse because of the pliability of the involved area. In Case No. 7 an equivocal diagnosis was made, and the surgical findings were likewise equivocal: eight pathologic reports considered the case malignant, six calling it sarcoma and two carcinoma. The patient was well four years after the operation. In Case No. 8 the roentgenologic diagnosis was equivocal; the surgical findings were for malignancy; the first microscopic diagnosis was non-malignancy, and the second was

sarcoma. Case No. 9 was uniformly considered by my associates as malignant; I myself considered the case as doubtful and waited ten days for improvement, during which time the ulcer did not diminish in size and accordingly a pylorotomy was performed. The surgical findings were equivocal, the first pathologic report being negative and the second positive. In Case No. 10 a tentative diagnosis of malignancy was given, operation removed the gallstone and gall bladder, and no lesion of the stomach was reported. A year later at a second X-ray examination the diagnosis was non-malignant pyloric obstruction, probably ulcer. A pylorotomy was performed and the surgical findings were equivocal; the pathologic report was non-malignancy.<sup>6</sup>

In all of the cases that I have seen, both prior to my original communication in Boston, in 1920, and for seven years since, I have seen only one case in which a positive diagnosis of benign ulcer was justified by repeated roentgenographic examinations, and in which the patient subsequently developed carcinoma and died of it. In this one case the carcinoma did not develop until after a gastro-enterostomy had been performed.

In conclusion, I would say that I believe the procedure which we follow in all cases of ulcer, namely, that of watching the ulcer diminish in size during a period of rest in bed, enables us to make a differentiation between malignancy and non-malignancy with as great a degree of certainty as can be done by microscopic examination of the pathologic section after its removal.

<sup>6</sup>A detailed study of the case, by Dr. F. W. Bancroft, appeared in the August, 1928, issue of "Medical Clinics of North America."

## EROSION OF THE RIBS DUE TO STENOSIS OF THE ISTHMUS (COARCTATION) OF THE AORTA

By O. C. RAILSBACK, M.D., and WILLIAM DOCK, M.D., SAN FRANCISCO  
From the Department of Medicine, Stanford University Medical School.

THE diagnosis of stenosis of the aortic isthmus during life depends on the demonstration of the extensive collateral circulation in the thorax. Walshe (1), in 1873, stated that "occasionally local expansile pulse aneurysmal to the feel (and sometimes strong enough to gradually wear away the ribs) may be felt from place to

place in the intercostal vessels." Walshe's statement apparently is based on Meckel's case (2), cited by Craigie (3). The erosion of the ribs shown in Meckel's figure (Plate 1) affects only the upper borders of two ribs. Craigie also cites a case of Jordan's (1830) in which the first and second ribs were "absorbed and sulcated." We have

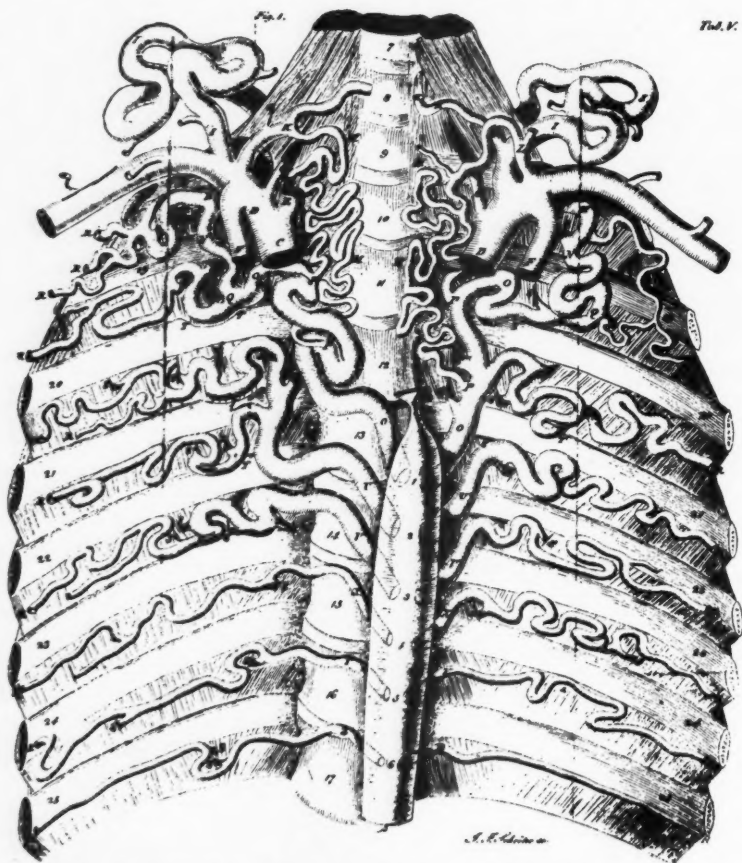


Fig. 1. A preparation of the collateral circulation inside the thorax in a case of coarctation of the aorta. The erosion of the third and fourth right ribs is clearly shown, and is notably of the upper borders. This preparation was made by wax injection of the arteries through the innominate, the injection filling all of the arteries down to the feet.—From A. Meckel, *Archiv f. Anat. u. Physiol.*, 1827, to face page 468.

found no later descriptions of this feature; it is not mentioned by roentgenologists (4, 5, 6) or internists (7, 8, 9, 10, 11) who have summarized the reported cases. In the case reported below there was the usual de-

there was a marked forceful expansile pulsation which extended to the right and above the sternoclavicular junction. There was a soft systolic bruit over this area but no thrill. The heart was definitely en-

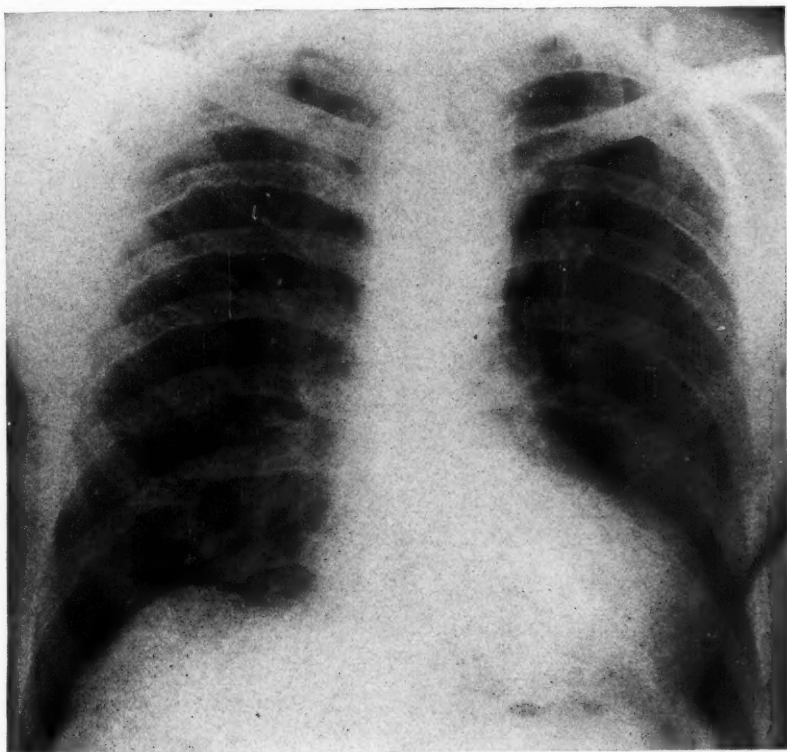


Fig. 2. Roentgenogram of chest of case of coarctation of aorta. Heart enlarged to left, supracardiac shadow normal, erosion of lower borders of ribs, right 4-9 and left 5-8, inclusive.

lay in recognition of the underlying vascular disorder, as well as an extraordinary roentgen picture of rib erosion.

Mr. T. R., age 45, entered Lane Hospital on January 8, 1927, complaining of stomach trouble of three years' duration. He also stated that three years previously he had noted a "tumor" in the right supraclavicular region, from which he had suffered some slight pain. He was well developed and well nourished, with lips and ears deep red, and not cyanotic. In the suprasternal notch

larged to the left, the point of maximum impulse being in the fifth intercostal space, 11.5 cm. to the left of the midsternal line. The supracardiac dullness was not appreciably increased. At the aortic area there was a rather high-pitched, somewhat harsh systolic murmur transmitted up the sternum and heard less intensely at the apex. The blood pressure was: right brachial, 190/90; left brachial, 164/80; rate 74. No mention was made of the pulsations in the arteries of the legs and feet. The reflexes

were all present and equal. The ophthalmoscopic examination was negative. Rectal examination was negative. The blood, urine, and Wassermann tests were normal. Roentgen-ray studies of the gastro-intestinal



Fig. 3. Detail of rib erosion; right seventh, eighth, and ninth.

tract were normal and those of the chest showed no pulmonary changes. The heart was somewhat enlarged in the transverse diameter, affecting principally the left ventricle. The aorta was within normal limits. The ribs on both sides showed a most remarkable scalloping of their lower margins posteriorly. This was most marked in the fifth and ninth ribs on the right (Figs. 2 and 3). The patient was dismissed January 18, 1927.

In January, 1928, the roentgen appearance of the chest was unchanged. The patient stated that all his life he had worked hard as a ranch hand and had never experienced any dyspnea, palpitation, precordial distress or pain, and had never noted any edema of the ankles. He had never suffered from dizziness, headache, or syncope and had never had epistaxis. Since his dismissal he had been free from gastro-intes-

tinal symptoms and had felt very well. The only complaint he made was that during cold weather he had occasional pain in the neck.

The man entered the hospital for re-examination, as the chance finding of Walshe's description of rib erosion in coarctation of the aorta suggested this diagnosis. Over the back in the region of the spines of the scapulae and below the angles of both scapulae, extending around into the axillae, forceful pulsations could be seen and felt, accompanied by a thrill. The intensity of both the pulsations and the thrills varied from time to time, the latter at times disappearing entirely. On either side pulsation in both the transversalis colli and circumflex scapular arteries could be obliterated by pressure lateral and cephalad, showing that the direction of the blood flow was down and toward the thoracic aorta. A systolic bruit, transmitted over most of the back, could be heard over all the areas of pulsation. No pulsation could be felt in either femoral triangle, but there were weak pulses in the abdominal aorta and at the level of Poupart's ligaments. Blood pressure readings were taken by auscultation and also with the Pachon oscillometer in arms and legs.

With the former the readings were:

Right brachial 200/100  
Left brachial 174/98  
Right femoral 164/140  
Left femoral 164/130

With the latter they were:

Right brachial 190/100  
Left brachial 170/100  
Right femoral 165/130  
Left femoral 160/130

Attempts to outline the arch and descending aorta by roentgen-ray studies were unsuccessful.

The rate of pulse transmission has not been reported in previous cases, although it offers the most obvious physiological

proof of aortic occlusion. In this case the pulse transmission rate was measured by taking pulse tracings (Frank capsule) and simultaneous electrocardiograms. The Q wave was used as a base from which to measure the rate of pulse propagation. The onset of the anacrotic wave was taken to mark the arrival of the wave at various points in the arterial system. The pulse reached the right subclavian artery 0.10 second after the Q wave of the electrocardiogram had appeared; from the subclavian to the other vessels the intervals and distances were as follows:

Right radial (56 cm.)	0.075 sec.
Left radial	0.08 sec.
Left transversalis colli at spine of scapula	0.03 sec.
Left eighth intercostal below angle of scapula	0.08 sec.
Right femoral at Poupart's ligament (53 cm.)	0.10 sec.
Right dorsalis pedis (128 cm.)	0.18 sec.

In normal individuals the femoral pulse precedes the radial by 0.01-0.02 second, the distance from the heart being greater and the rate of propagation less in the radial; in this case the femoral pulse arrived later than the radial. The rate of propagation in this case was 7.4 meters per second from subclavian to radial; 9 meters per second from femoral to dorsalis pedis, and if we assume direct transmission from subclavian or transverse aorta to femoral the value is 5.3 meters per second. The disproportion between this figure and that for transmission in the other vessels proves conclusively (in the absence of aneurysm) that the descending aorta is closed and the pulse follows a circuitous path in reaching the vessels of the lower half of the trunk.

The failure to confirm the diagnosis, which was suspected in 1927, can be explained only by the variable character of the pulsation of the superficial vessels. In this

patient, as in the one described by Weber (10), the collateral circulation is primarily carried out through the internal mammaries and intercostals, so that the epigastric vessels are not demonstrably enlarged and the collaterals about the scapulæ are less marked than usually described. The costal erosion was correlated only when Walshe's statement was encountered; it has been described rarely but it is undoubtedly pathognomonic of coarctation of the aorta. We believe that comparative pulse transmission rates to such vessels as femorals and radials are of considerable value in establishing the existence of aortic occlusion.

#### SUMMARY

We have described a patient with asymptomatic stenosis of the isthmus of the aorta in whom there was a comparatively small degree of superficial collateral circulation, but with numerous erosions of the third to ninth ribs in the roentgenogram as evidence of dilated intercostal vessels. The delay in transmission of the pulse to the femorals confirmed the existence of stenosis of the aorta.

#### BIBLIOGRAPHY

- (1) WALSHE, W. H.: *Practical Treatise on Diseases of Heart and Great Vessels*. London, 1873, p. 536.
- (2) MECKEL, A.: *Verschliessung der Aorta am Vierten Brustwirbel*. *Meckel Archiv f. Anat. u. Physiol.*, 1827, p. 345.
- (3) CRAIGIE, D.: *Instance of obliteration of aorta beyond arch, illustrated by similar cases*. *Edinburgh Med. and Surg. Jour.*, 1841, II, 427.
- (4) ASSMANN, H.: *Die Roentgen-diagnostik der inneren Erkrankungen*. Leipzig, 1921, p. 79.
- (5) DIETLEN, HERZ, and GEFASSE: *Roentgenbild*, 1923, p. 227.
- (6) VAQUEZ and BORDET: *Le Cœur et l'Aorte*, 1918, p. 125.
- (7) ABBOTT, M.: *Osler's Modern Medicine*, 1926, IV, 772.
- (8) BLUMENFELD, E.: *Spezielle Pathologie und Therapie innerer Krankheiten* (Kraus und Brugsch), 1925, IV, 541.
- (9) KING, J. T., JR.: *Stenosis of isthmus (coarctation) of aorta and diagnosis during life*. *Arch. Int. Med.*, 1926, XXXVHI, 69.
- (10) WEBER, T. P.: *Stenosis (coarctation) of aorta, with sudden death from rupture of cerebral aneurysm*. *Proc. Roy. Soc. Med.*, 1927, XX, 1227.
- (11) HEITZ, JEAN: *Arch. des mal. du cœur*, 1928, XXI, 104.



## TREATMENT RECORDS<sup>1</sup>

By JOHN F. HERRICK, M.D., OTTUMWA, IOWA

IT may seem presumptuous to again introduce the subject of records. However, the matter is so important that it is difficult to over-emphasize it. Radiotherapy has assumed an importance in medicine which renders it imperative that it be applied in the most scientific manner. One thing that is stressed by all scientific bodies and organizations whose purpose is the care of the sick, is that complete and comprehensive records should be made of everything discovered in the examination of the patient and everything done for him. It took many years to work out the requisites for acceptable surgical technic, so it must needs take time to develop a satisfactory technic in radiotherapy. Radiation has as great potentialities for good or evil, within its radius of usefulness, as has surgery, and should be surrounded in its application by every safeguard.

In the comprehensive program presented at this meeting the dosage question will be thoroughly discussed and shall not be considered in this paper. Herein is suggested only a plan of keeping simple but informing records of what is done for the patient treated by the X-ray. One of the greatest difficulties in the past has been the want of an universally accepted unit of measurement: the adoption of such a unit seems to be a question of only a short time. Meanwhile and in anticipation of a more satisfactory arrangement, we should strive to make our work as effective and safe as possible for the patient, not neglecting our own protection.

The record of any treatment should consist of a history and examination sheet on which is recorded all data obtainable. Blood count, urinalysis, and blood pressure read-

ings should be recorded. The condition of the heart and lungs and especially the arterial and capillary circulation are important. If gangrene or excessive reaction appears following treatment, which is found to result from diabetic or arteriosclerotic disease, it is difficult to explain why it was not anticipated and guarded against. Charts and diagrams may be part of the history. It were well also to outline in advance the plan of treatment.

The record of each treatment should be in such detail that any one familiar with X-ray terminology could easily read and understand it. If more than one exposure is given to a part, a record of the condition of the part should be made before the second or subsequent treatment is begun. Since this discussion has to do with records only, nothing will be said as to what is proper dosage, or when treatment should be repeated. The record should, however, show the factors used in the treatment, with a measurement of the output of the tube and the amount of radiation received by the exposed part. To do this it must show the voltage, milliamperage, filter, distance, and time. With these five factors known, the X-ray output has yet been found to vary; therefore the desirability of measuring the output. The radiologist doing therapy work has enough cause for anxiety in the variable reaction of different patients, without the added uncertainties of his physical apparatus.

So far, a perfect method of measurement of the output of any X-ray apparatus has not been discovered. The character of the rays and their biological effect are thought to be influenced by many factors. These are not considered in this paper and are mentioned only for the purpose of showing that there are reasons for advocating addi-

<sup>1</sup>Read before the Radiological Society of North America at the Thirteenth Annual Meeting, at New Orleans, Nov. 28-Dec. 2, 1927.

tional measurements of the rays. Obscure variations in the X-ray beam occasionally happen during treatment, bringing grief in their train. Such might have been revealed by a check on the output.

With a constant reading ionization chamber always in the track of the X-ray beam, one has a check on the output of the tube, and, of course, incidentally on the factors that make up the minute dosage received by the patient. Only by measuring the output of the tube during each treatment is one enabled to make corrections for the variations that all radiologists have found to exist in the operation of generators and tubes. Having a constant reading ionization chamber permanently set at a fixed distance from the focal point, once a desired skin dose has been determined for any focal skin distance it is easy to repeat the dose by repeating the minute unit reading of the ionization chamber, remembering that the physical factors in the generation of the rays must remain the same. In other words, the ionization reading is a more accurate criterion of the dosage given the patient than any calculation based on other factors.

With an ionization chamber in the track of the rays there are two other possible sources of error; the time of exposure and the focal skin distance. The radiologist has available a quite satisfactory automatic treatment timer which will relieve him of anxiety on that score. Then, it is well to measure the dose on the skin surface either by an electroscope or by a selenium cell.

The written records made during the treatment should show all the factors used, including the reading of the fixed ionization chamber and the cell on the skin of the part treated. With such records, it is possible to repeat a treatment or to correct a technic if it is found to be faulty. It may seem that the treatment is made so technical as to be almost ridiculous, but it is not more so than correct surgical technic, nor than is necessary for the best interest of all con-

2F. U.—Furstenau Intensimeter or selenium cell.

3R. U.—Roentgen units of ionization chamber.

Fig. 1. Specimen record card.

Name		Address [fill in]				Disease		Exophthalmic Goiter				
Miss Z.												
Date		Inch	Filter	Time	F. U. <sup>2</sup>	Total	R. U. <sup>3</sup>	Total	Part	Size	Series	Met. Rate +100: P. 140
1927	K. V.	Ma.	Dist.	Cu.-Al.	Min.	Min.	R. U.	Total <td>Treated<td>Area<td>Total F. U.</td><td>Remarks</td></td></td>	Treated <td>Area<td>Total F. U.</td><td>Remarks</td></td>	Area <td>Total F. U.</td> <td>Remarks</td>	Total F. U.	Remarks
4-6	120	6	12	h-3	10	0.7	3.	30	Thyroid	3 x 4 in.	7.	Less nervous P. 120
4-19	120	6	12	h-3	10	0.7	3.	30	Thyroid	3 x 4 in.	14.	Less nervous P. 110
5-3	120	6	12	h-3	10	0.7	3.	30	Thyroid	3 x 4 in.	21.	Less nervous P. 105
5-26	120	6	12	h-3	15	0.7	3.	45	Thyroid	3 x 4 in.	32.	No erythema P. 90
6-15	120	6	12	h-3	15	0.7	3.	45	Thyroid	3 x 4 in.	43.	No erythema P. 84
7-13	120	6	12	h-3	15	0.7	3.	45	Thyroid	3 x 4 in.	54.	Improved P. 84
8-9	120	6	12	h-3	10	0.7	3.	30	Thyroid	3 x 4 in.	61.	Gain. 10 lbs. P. 90
9-6	120	6	12	h-3	15	0.7	3.	45	Thyroid	3 x 4 in.	72.	No erythema P. 90
10-15	Metabolic rate +10. Gain 20 lbs. Pulse 72.											
11-15	Feels quite well. Pulse 72.											

cerned. Figure 1 is a copy of an actual record such as is made during and immediately at the conclusion of each exposure. On the face of the card are recorded the factors used in the treatment, with brief notations. On the reverse of the card additional notes and the follow-up record may be entered.

#### DISCUSSION

DR. HERRICK (closing): I have in mind a condition which may result, for instance, from a mild case of diabetes, in which you have a chronic arteritis and in which the circulation in the part treated is reduced very low. A person treating a case of this kind, not knowing the conditions, is in danger of producing a burn with a very small dose. Every item in connection with the history of the patient is exceedingly important.

There is a great deal of criticism of the

selenium cell, but from its use for a number of years, I feel that it is a simple method of determining the skin dose. It tells one whether he has gotten a little closer or a little farther than he thought he had, which may be possible even with an ionization chamber fixed in the tube stand.

I want to say a further word on the question of the constant reading ionization chamber; it covers all the factors of safety except the time and the focal distance. The automatic timer will determine the time. The distance must be determined by measurement, but most important is the actual dose received by the exposed part. With either the electroscope or the selenium cell laid in the part treated, one can determine the exact dose received, which should be made a part of the record, thus completing it as nearly as possible. Such a record of each treatment, with the observed results, gives a basis on which further treatment can be determined.

---

## CASE REPORTS AND NEW DEVICES

### MODIFICATIONS OF ELECTROSCOPIC CHARGING DEVICE

By ROBERT B. TAFT, M.D., B.S.  
Riverside Infirmary, CHARLESTON, S. C.

Since the author described<sup>1</sup> his charging device for the electroscope, two modifications have suggested themselves, both of which have been in use for a length of time sufficient to prove their usefulness.

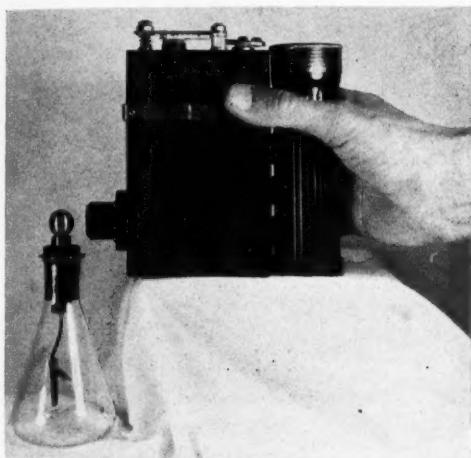


Fig. 1. The portable instrument to be used in conjunction with the simple open electroscope. (See text.)

Figure 1 shows a portable instrument to be used in conjunction with the simple open electroscope such as is employed for lecture-room demonstration. On the spark coil is mounted the metal casing of a two-cell flashlight and a push button is placed within easy reach of the operator's thumb. In grasping the metal case, the hand establishes a ground for the instrument without caus-

<sup>1</sup>"Charging Device for Electroscope," *RADIOLOGY*, December, 1926.

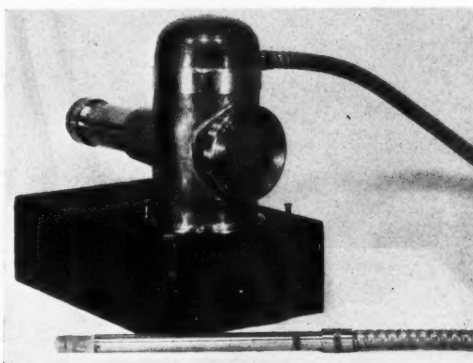


Fig. 2. The author's primary standard electroscope. (See text.)

ing any shock to the operator. The needle point is soldered to the positive high tension pole and protected from injury by a hard rubber tube. If the vibrator spring is ground down very thin, the length of the spark is reduced to about 3/16 inch and only a small amount of current is consumed from the batteries. Even in continuous use, the batteries will last for several months.

Figure 2 shows the author's primary standard electroscope into which is incorporated this charging device. Two No. 6 dry cells (which also light the lamp casting the shadow of the leaf) and the spark coil are included in the hollow base on which the electroscope stands. A metal tube coming up through the bottom of the lead case carries the wire up to the needle point, the distance of which from the leaf support is adjustable. The push button on top of the base is connected in the primary circuit.

Aside from the simplicity that characterizes these instruments, their particular feature is the unfailing ability to deliver the charge under the most unfavorable conditions of hot and rainy weather.

## ROENTGENOLOGIC DIAGNOSIS OF ANENCEPHALUS<sup>1</sup>

By N. J. NESSA, M.D., Sioux Falls Clinic,  
SIOUX FALLS, SOUTH DAKOTA

THE rapid entrance and application of roentgen diagnosis to the various specialties in medicine and surgery have been observed with much interest by us as roentgenologists. The gradually increasing field of pathology recognized and diagnosed



Fig. 1. Roentgenogram of the pelvis.

roentgenologically offers an inspiration to members of our specialty, and also brings us in touch with men with investigative minds, oftentimes located in fields where a large amount of clinical material presents itself.

In 1917 Case (1) reported the first instance of roentgen diagnosis of anencephalus, before birth, and again (2), in 1926, reported three additional cases, similarly diagnosed, at which time he bibliographically referred to Campbell and Willetts' report of one similarly diagnosed in 1923; Spangler (3), two cases in 1924; E. B. Andersen and T. O. Menees,<sup>2</sup> two cases in 1925; Doub (4),



Fig. 2. Roentgenogram showing collapsed cranium.

four cases in 1925. Maier (5), of Chicago, in 1927 reported two additional cases. This brings the published report to date to fifteen cases.

James T. Case states that the frequency of this anomaly, as observed by him, is 5 in 1,620 pregnancies. Before the advent of associated roentgenologic diagnosis in this field, the obstetrician was dependent entirely upon the older and more indefinite methods, briefly stated as follows: (a) hydramnios, (b) difficulty in locating fetal head, (c) faint fetal heart tones, and (d) exaggerated fetal movements. The roentgenologic examination in anencephalus shows (a) absence of the fetal cranial vault, (b) small orbits, (c) absence of sella turcica, and (d) tendency to cervical spina bifida.

The case report which I wish to present at this time was diagnosed roentgenologically at the Sioux Falls Clinic, and offers the following history: November 9, 1926, Mrs. L., white, age 41, primipara; family and personal history negative. Menstrual history normal; 4 days' duration, 28-day inter-

<sup>1</sup>Read before the Radiological Society of North America, at the Thirteenth Annual Meeting, at New Orleans, Dec. 1, 1927.

<sup>2</sup>X-ray in the Pre-natal Diagnosis of Fetal Monstrosity, E. B. Andersen, in collaboration with T. O. Menees. *Am. Jour. Obst. and Gynec.*, 1925, IX, 382.



val, some dysmenorrhea. Patient married in August, 1924; last menses Aug. 27, 1926. Complains of nausea, otherwise no complaints. Height 5 ft. 7 in.; weight 147 pounds. Blood and urine negative.

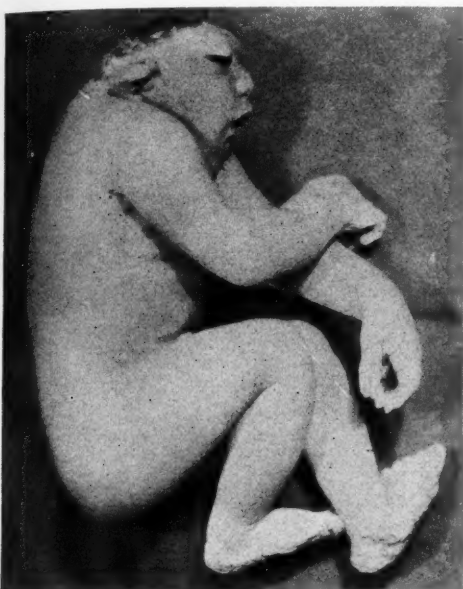


Fig. 3. Lateral view of the fetus.

Patient lived in neighboring town and did not present herself for further examination until May 7, 1927, at which time physical examination, made by attending obstetrician, Dr. E. L. Perkins, was as follows: "Patient feels fine; fetal heart tones normal; fetal movements very active; no evidence of fetal head can be determined. Referred to roentgenologic department for diagnosis." Roentgenologic report as follows: "Abdomen shows the presence of near-term fetus, cephalic presentation. No cranial vault present. Diagnosis: anencephalus."

The patient went home, but returned to the Sioux Falls Clinic on July 25, 1927, at which time she was admitted to the hospital. She was not in labor at this time after a period of 10 months and 24 days.

From that time the history of the case is as follows:

July 26, 9:00 A. M. Under gas anesthesia, Barnes bag inserted to start labor.

July 27, 8:25 A. M. Bag expelled.

9:40 A. M. Delivery of stillborn female child, weighing 7½ pounds, presenting the anomaly of anencephalus associated with club-foot.

#### SUMMARY

1. Roentgenologic diagnosis of anencephaly before birth is a reliable and important method.

2. Absence of cranial bones, absence of sella turcica, small orbits, and tendency to cervical spina bifida are the usual associated roentgenologic observations.

#### REFERENCES

- (1) CASE, JAMES T.: Anencephaly Successfully Diagnosed before Birth. *Surg., Gynec. and Obst.*, March, 1917, XXIV, 312.
- (2) CASE, JAMES T., and COOPER, JOHN E.: Early Diagnosis of Anencephalus. *Surg., Gynec. and Obst.*, August, 1926, p. 198.
- (3) SPANGLER, D.: Value of Roentgen Ray in Diagnosis of Atypical Pregnancies, with Report of Two Cases of Anencephaly Diagnosed before Birth. *Am. Jour. Roentgenol. and Rad. Ther.*, March, 1924, XI, 238.
- (4) DOUB, H. P.: Obstetrical Roentgenology, with Special Reference to Anencephaly. *Am. Jour. Roentgenol. and Rad. Ther.*, July, 1925, XIV, 39.
- (5) MAIER, R. J.: Diagnosis of Anencephalus before Birth. *RADIOLOGY*, August, 1927, IX, 166.
- (6) DORLAND, W. A. N., and HUBENY, M. J.: *The X-ray in Embryology and Obstetrics*. Bruce Pub. Co., St. Paul, 1925.

#### DISCUSSION

DR. JAMES T. CASE (Battle Creek, Mich.): The study of anencephaly is important. It is well worth remembering that it is possible by X-ray study to demonstrate anencephalus before birth. It is an unfortunate thing for a woman to go through labor for the delivery of an anencephalous monstrosity. Whenever there is any possible question of such a deformity, X-ray

examination should be made. Exaggerated tension of the uterus with considerable volume of the abdomen; hydramnios; difficulty in finding fetal poles; difficulty in identifying fetal head; convulsive movements of fetus; exaggerated *ballotement*, all suggest the need of an X-ray examination to rule out a possibility of anencephaly. Of course, after labor has begun, by digital touching of the presenting part, the form and volume may sometimes permit recognition of an anencephalus when the cephalic extremity presents. We have seen, in the Maternity Department of the Battle Creek Sanitarium, four cases in which a diagnosis of anencephaly was made before the beginning of labor. In each case, the diagnosis was based upon atypical physical findings,

plus the proof furnished by the roentgenogram and verified by operative delivery. It is especially important that such a monstrosity should be thought of and looked for before doing a cesarean section. A cesarean section in such a case would be a catastrophe.

My colleague, Dr. Upson, has recently shown an interesting case of hydrocephalus by the use of the X-ray.

DR. NESSA (closing): I presume the main thing in making such diagnosis, as Dr. Case tells me he does, is not to recommend continuing pregnancy under such circumstances. We were unable to follow up the case cited.

---

# EDITORIAL

M. J. HUBENY, M.D. . . . . *Editor*

BENJAMIN H. ORNDOFF, M.D. } *Associate Editors*  
JOHN D. CAMP, M.D. }

*Contents of RADIOLOGY copyrighted by the  
Radiological Society of North America.*

## THE PLACE OF RADIOLOGY IN THE UNDERGRADUATE MEDICAL CURRICULUM<sup>1</sup>

Almost all physicians do general practice of medicine for a period after their graduation from the medical school. Some take up one or another specialty within a few years.

In 1926, H. G. Weiskotten,<sup>2</sup> of Syracuse University College of Medicine, endeavored to ascertain the present tendency toward specialization by physicians in this country through a questionnaire sent to all the graduates of all the Class A Medical Schools in the United States for the years 1915 and 1920. Of the 1,379 graduates of 1915 answering the questionnaire, 42.5 per cent were specializing and 57.5 per cent were still doing general practice. Of the 1,526 graduates of 1920 answering, 36.1 per cent had already, within six years, limited their practice to a specialty, and 14.9 per cent stated that they contemplated doing so within the next five years. This would indicate that at the end of eleven years 51 per cent of the graduates of 1920 would be specializing, as against 42.5 per cent of the 1915 graduates who were specializing after a corresponding period. Although this and other evidence from many sources indicates an increasing tendency toward specialization, the fact remains that more than 50 per cent of medical graduates are general

practitioners at the end of ten years, and a much larger percentage—in fact, almost all—do general practice for one or more years after graduation.

The curriculum in the undergraduate medical school is intended to provide such instruction, courses, and experience to students as to best prepare them for the job they will have to do in the future, and there is no doubt but that that job consists largely of the duties of the general practice of medicine. It is not necessary that the curriculum of the undergraduate medical school should provide for the special training required by the specialist, because, as a matter of fact, those who specialize do, or at least should do, more or less graduate work in preparation for their particular specialties before they undertake to practise them.

The place of any subject in the curriculum must be determined to a large extent by the practical applicability of the subject in the general practice of medicine. However, we must not overlook the fact that it is necessary and highly desirable to include in the undergraduate course certain subjects, a large part of which will not be used to any great extent in every-day practice. They comprise parts of a general knowledge of the complex subject of medicine. They are just as important as, and sometimes even more so than, other subjects having constant direct practical application. Much of the anatomy, for instance, or of the physiology in the regular medical course is not used in routine practice, yet no one would consider a medical training adequate that did not give the student at least a good general knowledge of the make-up of the human machine he is to keep in operation and repair, or how it functions. Many of the finer points in anatomy and physiology

<sup>1</sup>Read before the Radiological Society of North America at the Thirteenth Annual Meeting, at New Orleans, Nov. 28-Dec. 2, 1927.

<sup>2</sup>Bull. Assn. Am. Med. Colleges, January, 1927, II, No. 1, pp. 29-47.

and in other subjects studied by the undergraduate medical student, have no direct practical application in routine practice, but they may be an important part of a medical education, and knowledge of the principles involved may be most enlightening to him.

The place of any subject in the undergraduate medical curriculum should be determined (1) by its general medical educational value and (2) by its direct and practical application in diagnosis and treatment. The place of radiology in the undergraduate medical curriculum must be determined largely by its general educational value and by its practical usefulness in the general practice of medicine, not in the specialties, for the reason that the undergraduate curriculum is intended to prepare the student for his next job, which, as has been pointed out above, is largely general practice and not practice of the specialties.

With the development and perfection of apparatus and methods of application, the employment of radiology in diagnosis and treatment in all branches of medicine has rapidly increased and it has long been established as one of the essential resources of the physician. Whether or not it will be practical or desirable for any given student to employ it to any considerable extent in his future practice, it is still necessary that he should be taught the fundamental principles of the subject and its general application, as a part of his medical education. Such instruction must, of necessity, be given by the radiology specialist. Unfortunately the specialist tends to "shoot over the heads" of his students and tries to teach them from the standpoint of the specialist. He tries to teach them too much of the unessentials—subjects which may be of great interest to the radiologist but tend to confuse the average student. But this same criticism is applicable to almost all other subjects in the curriculum. The different branches are taught mostly by specialists.

In fact, the faculty is made up chiefly of specialists. It is only an occasional good teacher who can impart to his students a knowledge of the essential facts in his subject and limit himself to these. It should be possible to present the essential general principles and facts about radiology to the class in a few lecture periods. I feel that a man who cannot do this within a total of five or six hours, in addition to the collateral reading his students should do at the same time, is a poor teacher.

So much for the place of radiology as a part of general medical education. The matter of the place of practical application of radiology in diagnosis and treatment requires further discussion.

It is by far the most important matter for the medical student to learn to employ those methods of diagnosis and treatment which he will be able to employ in his practice later. If he learns to depend upon apparatus and facilities to which he will not have access, such training or experience tends to unfit him for his job. Even in those instances in which a special method, like that of radiology, may be the best means of arriving at a diagnosis, if it is not available to the practitioner, it is still not of much practical value to him. This leads to the question as to the extent to which radiology is available to the average physician and the extent to which it is practical for him to take advantage of it.

Radiology of varying quality is available in most of the hospitals of the country; also many of the medical groups conducting group practice (which seems to be growing in this country), include some provision for radiology. In addition, there are radiological laboratories and radiological specialists in most of the cities, where radiological work is available. Although I do not know much about it, I would not be surprised to learn, if the truth were known, that a good part of the radiology available is not of the



M. J. HUBENY, M.D., Chicago  
President of the Radiological Society of North America





highest quality. This is especially likely to be true because of the fact that increased demand and other factors have resulted in entrusting so much to incompetent technicians who undertake to do and presume to know what it takes expert medical graduates years to learn. The physician who must depend upon this kind of radiological service would often be better off—and his patient would be, too—if he depended upon his own resources.

In 1923, according to W. C. Rappleye,<sup>3</sup> of the Commission on Medical Education, 56.2 per cent of all medical graduates were located in communities of less than 50,000. A large part of these were located in rural sections or in small communities where they did not have easy access to radiology to any extent to aid them in their work. These physicians must depend upon other available means at their command, notwithstanding that radiology might be more dependable in certain instances, if available.

It would be interesting to know the extent to which it is practical to take advantage of radiology and the extent to which it is needed, even in practice in cities where it is available. In hospital practice, where radiology can be had for the asking, the physician is disposed to call for it to aid him in a diagnosis or to make a diagnosis for him which he could have made just as well with other less expensive means at his command, if he had put forth the proper effort. In private general practice in the city where radiology can be secured, a very small proportion of patients are referred for it. I doubt whether the average general practitioner in the city takes advantage of radiology on an average of once a week. In actual practice, therefore, radiology is employed only to a limited extent in the general practice of medicine, which is the main job for which the undergraduate medical curriculum is intended to prepare the student.

The medical student learns from the instruction he receives from his teachers, and from his experience and observation in the management of patients. The methods of diagnosis and treatment set before him by his instructors are likely to be followed by him later to a greater or less extent. If the student during his third and fourth or clinical years learns, from the examples set before him by his teachers, to send his patients to the X-ray department and to depend upon the report as a means of diagnosis and to underestimate the value of other means, when he gets out into practice where he cannot or will not have radiology available, he will be poorly prepared for his job.

Take the matter of fractures, in which radiology is of superior value in diagnosis and management. The practice in hospitals and large fracture clinics of depending much upon the X-ray examination and less upon other methods, fails to afford the best experience for the student who may have to treat most of his fractures without X-ray examination. Another good example is chest examinations. Although it may be granted that more can be learned from radiological examination than from physical examination, it still remains a fact that it is not practical and probably never will be practical to have radiological chest examinations made of any large proportion of cases in general practice. It is important, therefore, to teach the student by example and practical experience to utilize means at his command and particularly not to be dependent upon radiology, to which he can resort only to a limited extent. For this reason I doubt whether, in the interest of the student, radiology should be employed in the teaching clinic to the same extent that it should be employed in the non-teaching clinic.

The same limitations apply to radiology for therapeutic purposes. In those diseases and conditions in which X-ray and radium

<sup>3</sup>Preliminary Report of Commission on Medical Education, January, 1927, p. 29.

therapy are of superior value or are the only available therapeutic measures, there is no question but that the student should be informed of their value, regardless of the fact that he will have to refer his patients to specialists for treatment. On the other hand, overemphasis on the subject should be avoided in the undergraduate curriculum, wherever radiology is of less value than other available measures, or is of doubtful value.

#### SUMMARY AND CONCLUSIONS

1. The chief purpose of the undergraduate medical curriculum is to give the student a broad, general knowledge of medicine and to prepare him for general practice.

2. Radiology is a subject of great importance in medicine but technical difficulties and other circumstances greatly limit its usefulness in general practice.

3. Not more than five or six hours in the curriculum should be required for presentation of the broad, general principles of radiology and their application.

4. The practical application of radiology should thoroughly permeate the entire curriculum in the two clinical years, and should constitute a proper part of the work in all of the clinical branches.

C. C. BASS, M.D.

*Tulane University School  
of Medicine, New Orleans.*

#### SCIENTIFIC AWARDS

*To the Officers and Members of the Radiological Society of North America:*

Your Committee on Scientific Awards beg to report that they have awarded the First Prize to the scientific exhibit of Dr. Henry K. Pancoast, Dr. Karl Kornblum, and Dr. Temple Fay, of Philadelphia, on "Encephalography."

The Second Prize is awarded to Dr. Eben

J. Carey, of Milwaukee, for his exhibit on "The Dynamics of Bone."

The Third Prize is awarded to J. L. Weatherwax, M.A., and Dr. Bernard P. Widmann, of Philadelphia, for their presentation of "Physical Principles of Radiation Therapy and Their Clinical Application."

#### IN MEMORIAM

ROBERT KNOX, M.D., M.R.C.P., D.M.R.E.,  
M.I.E.E.,

Honorary Consulting Radiologist, Queen Alexandra Hospital, Millbank; Director of the Electrical and Radiotherapeutical Department of the Cancer Hospital.

A writer in the *British Medical Journal* says that, "The untimely death, on September 21, 1928, of Dr. Robert Knox, in his sixty-first year, inflicts a heavy loss on British radiology. Knox was in the very front rank of his profession, and had come to occupy a unique position in the esteem and affection of X-ray workers, both in this country and abroad. Few men have held higher ideals and so unremittingly endeavored to live up to them."

Dr. C. Thurstan Holland continues: "My acquaintance with Robert Knox began about twenty-three years ago. It began radiologically. I happened to see some very beautiful radiographs which were taken at a time when it was not so easy to get good results as it is now. I asked who took them, and then paid a visit to the Northern Hospital at Highgate to find a youngish, very reserved, very enthusiastic man in charge of an X-ray department which, in those days, was turning out better work than that produced in most hospitals. Knox was one of the most reserved of men; he did not make friends easily, but if once you penetrated his armour you found, hidden by this reserve, a most lovable man and a most sterling friend.

Happy in his home life, happy in his wife and his children, his work was at the same time his only hobby. The amount of work he did was stupendous, and it was all done in the most thorough manner. Knox was fortunate in that he very early became a good pathologist; this knowledge of pathology did him good service when he took up X-ray work, and was one of the things which made his opinion of such great value."

The sketch continues: "His name became associated with an immense ability for taking pains, and this, coupled with a shrewd intelligence and a patient sincerity, brought him among the acknowledged leaders of his profession. . . . Apart from his hospital and consulting practice, Knox worked unceasingly and ungrudgingly for British radiology, and did not spare himself in its service. His essential fairness and unselfishness, his freedom from prejudices, his wise counsel and his gifts as a conciliator found great scope on councils and committees. Knox was editor of the *British Journal of Radiology* for more than thirteen years, and his well-known book, "Radiography and Radio-therapeutics," brought him great distinction."

He had held office in every radiological society and sat on the examining boards of the universities.

Dr. M. C. Sosman, of Boston, was elected Secretary-Treasurer for the ensuing year.

---

#### MEDICAL PROFESSION OF WESTERN HEMISPHERE TO HOLD CONGRESS IN HAVANA

The next congress of the Pan-American Medical Association will be held in Havana, Cuba, from December 29, 1928, to January 3, 1929. The program, which is being arranged by the President, Dr. Fred H. Albee, of New York City, will be a strong one, and will include four orations upon the subjects of surgery, medicine, pediatrics, and tropical medicine.

Dr. William J. Mayo will give the Oration on Surgery, and Dr. Lewellys Barker, of Johns Hopkins University, the Oration on Medicine. Papers will be read in both Spanish and English.

This congress will be representative of the medical profession of the entire Western Hemisphere. Chapters of the Association have been and are being organized in various centers of North America and Central America, as well as in the Antilles, all of which will be represented at the Congress.

One of the recent accomplishments of the Pan-American Medical Association is the establishment of the Pan-American Hospital in New York City for the benefit of the Latin-speaking people.

A large attendance is solicited.

---

#### NEW ENGLAND ROENTGEN RAY SOCIETY

At the last meeting of the New England Roentgen Ray Society the resignation of Dr. John D. Camp as Secretary-Treasurer of the Society was accepted, Dr. Camp having removed to Rochester, Minnesota, where he has resumed association with the Department of Roentgenology of the Mayo Clinic.

---

#### THE ANNUAL MEETING

The registration at the Chicago meeting was well over eight hundred. No decision has been reached as to the place for the next meeting—announcement may, however, be looked for in an early issue of *RADIOLOGY*. Comments on the Scientific and Commercial Exhibits will appear in the next issue.

INTRODUCTORY WORDS  
AT THE DEMONSTRATION OF  
THERAPEUTIC METHODS AND RE-  
SULTS AT RADIUMHEMMET

HELD BEFORE THE SECOND INTERNATIONAL  
CONGRESS OF RADIOLOGY

By PROF. DR. GÖSTA FORSSELL, STOCKHOLM

We have ventured to reserve so great a part of the precious time of the Congress for demonstrating the working methods at our radiotherapeutic clinic, Radiumhemmet, and the results there obtained, because in our opinion one of the tasks of the Congress is to give an insight into the radiological work carried out in the country that has the honor of holding the Congress.

For giving you an idea of what we are doing for radiotherapy of tumors we have tried to proceed along two lines: In the first place, we have prepared two reports, distributed to the members of the Congress, in which we have given an account of the organization, methods in use, and therapeutic results of Radiumhemmet; secondly, we now wish to show you, by demonstration of patients, the practical results of our work for combating cancerous disease. It is not my intention, therefore, to detain you with any detailed statistical data but only in a few words give you some idea of the organization and activities of Radiumhemmet and the main results of the treatment.

The "Radiumhemmet" is a small hospital of thirty-four beds for the treatment of cancer by radiotherapy, founded in 1910. It is maintained by the Stockholm Cancer Society, and is subventioned by the Municipality of that city and by the Swedish Government. The organization of the Radiumhemmet comprises an effectively working Department of Control, which maintains contact with the patients after they leave the hospital. They are all kept under careful and repeated observation during the first years after treatment, and are examined

once a year afterwards. This system of after-observation gets its strongest support from the fact that the Government, in conformance with a decision of the Swedish Parliament, defrays the traveling expenses of all poor patients to and from the hospital. This makes the maintenance of a personal observation and control possible in most instances. With few exceptions we have been able to keep continuous trace of all our cases for the last fifteen years.

With the exception of a few cases of cutaneous cancer, during the first years of the institution we treated only such tumors as for some reason or other could not be operated on. Later, when—thanks to improved technic and the acquisition of a larger supply of radium—we had seen a great improvement and some instances of primary healing in cases of that kind, we went so far as to treat borderline cases also. At last we also gradually began to treat operable cases of certain kinds of tumor, either by radiotherapy alone or by a combination of surgery and radiotherapy.

Thus we have gone on, slowly and cautiously widening the field of radiotherapy. During the past we have treated by that method an ever-increasing number both of borderline cases and operable cases; especially cases of cutaneous cancer, cancer of the lip, the uterus, the thyroid, the oral cavity, the vulva (the two last-named often in connection with surgical intervention), cancer of the ovaries (as far as possible with surgery to aid), and many sarcomata. Carcinoma of the breast we still treat by surgery whenever possible, often by surgery and radiotherapy combined. All carcinomata of the digestive tract that are amenable to surgical intervention are operated on. In several types of tumor we have now obtained both primary and lasting healings, but only as far as a few groups are concerned are the cases of primary healing that have been observed for a sufficient length of time nu-



merous enough to constitute a test when it comes to proving the permanency of the radiological healing. The groups that may thus be referred to are: Cutaneous cancer of the face, cancer of the lip, cancer of the oral cavity, cancer of the uterus, sarcoma.

Of a total of 207 applicants with cancer of the skin of the face for the years 1910-1915, inclusive, 142 have remained healed, which means a percentage of *absolute cure* of 68 per cent. If, however, we count only technically operable cases, the figure for *relative cure* is 78 per cent.

In lip cancer we have obtained a permanent healing in 45 cases of a total of 66 applicants, that is, in 68 per cent of the cases. For the operable cases the percentage of *relative cures* was 86 per cent.

In cancer of the mouth we have five-year healing in 71 of 113 cases, that is, a figure of *relative cure* of 63 per cent of all cases radiologically treated.

In none of the cases in which there were regional metastases to the lymph nodes was permanent healing obtained.

On the other hand, in cancer of the mouth confined to the primary site, five-year healing has been obtained in 21 out of 68 cases, that is, in 31 per cent.

By surgery and radiotherapy combined a healing for at least five years was obtained in 13 (about 60 per cent) of 22 cases.

In cancer of the uterine cervix our absolute healing figure is 22.4 per cent by a total number of 500 applicants.

Of 145 operable and borderline cases, 67 have obtained a five-year healing, corresponding to a relative cure of 46.2 per cent.

In 234 inoperable cases of cervix cancer, there has been five-year healing in 16.7 per cent of the cases treated.

In cancer of the uterine body the figure of absolute healing is 43.5 per cent (20 out of 46 cases), and the relative performance 60 per cent, or five-year healing in 15 of 25 operable cases.

Of the total of 543 cases of sarcoma treated at the Radiumhemmet during the period 1910-1922, 181, or one-third, were free from symptoms when re-examined in 1925. Of the 238 primary tumors treated by radiotherapy, only 58 (24 per cent) have remained free from symptoms.

Of the 151 sarcomata in which a combined surgical and radiological treatment was used, 95 (or two-thirds) have remained free from symptoms.

For estimating the value of radiotherapy in cases of tumor it is essential to try to obtain a survey of the permanency of the cures established by radiological treatment of tumors. To get an insight into this question I have examined the material of tumorous cases at Radiumhemmet, observed for more than five years. The result of this work I have set forth in a publication, a copy of which I beg to present to the Congress. In this work you will find not only an account of the ultimate results of our radiological methods of treatment, but also a narration of the principles of our treatment and the conclusions we have considered ourselves justified in drawing with regard to the factors influencing the radiological healing in cancer. I will mention only that the results of our comparison between the final achievements of surgery and radiotherapy as regards the treatment of malignant tumors are as follows:

In those types of tumor that offer a fair chance of obtaining a primary healing by radiological treatment, the duration of the healing obtained by radiotherapy is, both as regards the relative and the absolute performance, in every way comparable to the results obtained by surgery.

When primary healing—immediate freedom from symptoms—has once been secured by radiotherapy, the percentage of recurrences in most of those forms of tumor is lower than after primary surgical healing, and in none of the groups comprised in this

inquiry is it higher than the percentage of recurrences following radical operation.

The duration of the *period of latency* is very much the same for recurrences after radiological treatment as for recurrences after radical operation. Most of the recurrences take place during the first and second years after primary healing, the majority of them during the first year. After the third year there are only scattered instances of recurrence. After the fifth year they are rare; still, cases have occurred as late as in the eighth and ninth years. After the ninth year our material does not show any recurrence.

In radiotherapy of tumors the *palliative effect* plays at least as important a part as the *curative effect*. I have tried to obtain a general gauge of the palliative effect in our cases by examining the percentage figure of cases of primary healing obtained during the last seven years at Radiumhemmet in malignant tumors treated exclusively by radiotherapy. Of a total number of 4,470 applicants, primary healing was attained in 1,714 cases, corresponding to an absolute palliative effect of 38 per cent. This figure is a high one, explained by the fact that a relatively great number of cases are of favorable nature. If excluding the most favorable groups of cancer, namely, cutaneous cancer, cancer of the lip, and uterine cancer (in all, 2,131 cases, with 1,276 healed), and sarcoma (413 cases, with 100 healed), as well as the most unfavorable forms of cancer (250 cases, none of which became free from symptoms), there remain 1,676 cases of cancer, of which 338, or 20 per cent, attained primary local healing.

In cancer of the intestine we have in no case obtained certain freedom of symptoms. If only considering the 3,354 cases in which radiological treatment only was carried out, primary local healing was obtained in 1,714 cases, corresponding to a relative palliative effect of 51 per cent. In the most favor-

able groups of cancer primary healing was obtained in 60 (90 per cent) of the treated cases.

These statistical data strongly confirm the palliative effect of radiotherapy in tumors.

We have thought the best way of showing the results of the treatment, however, to be a demonstration of patients cured by radiotherapy. My colleagues at Radiumhemmet will now give you a speedy demonstration of our technic and therapeutic results. I hope that seeing for yourselves the patients who have had their tumors healed will, better than any words, give you an idea of the value of radiotherapy for the successful treatment of malignant tumors.

---

#### ACCURATE DETERMINATION OF COLOR MADE POSSIBLE BY NEW INSTRUMENT

The exact duplication of any color at any time and at any place has been made possible by a new colorimeter developed by Professor Arthur C. Hardy, of the Department of Physics at Massachusetts Institute of Technology, and described by him at the annual meeting of the Optical Society of America, at Washington on November 1. For instance, should a new color be developed by fashion dictators at Paris, a photoradiogram of the color analysis can be sent to New York, and there duplicated by dye experts, even though these men will not be able to see an actual sample of the original color for some days.

The new color analyzer, known as a recording spectrophotometer, eliminates human judgment entirely, and automatically measures the color and wave lengths of any substance rapidly and with precision. Not only does it measure color accurately but it makes a record by which it is possible to match that shade at any time, thus eliminating all possibility of fading of a standard color.

## THE INSTRUMENT

Ordinary white light, or sunlight, if passed through a triangular glass prism, is broken up into rays of various wave lengths and colors, varying from deep red at one end of the spectrum through orange, yellow, green, and blue to deep violet at the other end—just as rain drops break up white sunlight to form the same succession of colors in a rainbow. Similarly, if colored light is passed through a triangular prism, it is broken up into bands of different wave lengths and colors, with some colors more prominent than others. Colors, as we know them, are not pure colors of a single wave length, but are mixtures of various wave lengths. The prism, for instance, will show that a sample of green dye might contain a little of every color, a decided proportion of red, and a maximum of bluish green, green, and yellowish green.

The new spectrophotometer, a combination of a powerful optical system and electrical devices, analyzes the spectrum of colors and makes a chart of the analysis. The specimen color to be analyzed is placed in a holder and illuminated by a special ribbon-filament incandescent lamp. Magnesium carbonate, the whitest substance known, is used as the standard of comparison in the laboratory instrument. Light is alternately reflected from the specimen and the magnesium carbonate, and acts upon a photo-electric cell in which it sets up an alternating current.

This current is fed to a vacuum tube amplifier which increases the power 10,000,000,000 times. The color of the specimen is analyzed at each wave length of the light spectrum, and the record is made automatically by a pen moving over a revolving drum. The result is a description of the color, by means of which the identical shade may be reproduced as often as desired.

The light from the incandescent lamp falls perpendicularly on both the specimen and the magnesium carbonate standard, and, after reflection from the specimen and standard, enters the slit of an ordinary spectrograph system.

Immediately in front of the slit is a rotating glass disk having alternate silvered and transparent segments. The disk is so located that light from the standard enters the slit when a transparent segment is in the beam, and light from the specimen when a silvered segment is in the beam. The spectrograph system disperses the light and a second slit selects the proper wave length band. Light passing through the second slit falls on a photo-electric cell which receives monochromatic, or single wave length, light of pulsating intensity when the standard and specimen reflect different amounts of light in the spectral region. This pulsating light intensity is changed to a pulsating current by the photo-electric cell, is amplified, and is then employed to run a small motor. This motor actuates a shutter in the beam between the light source and the standard, and automatically finds a position where the pulsations of the light cease. This position is independent of the characteristics of the photo-electric cell. A pen is attached to the mechanism controlling the shutter to record the reflecting power of the specimen on the rotating drum. A second motor rotates the drum and at the same time drives the slit across the spectrum, thus giving a complete color analysis in a time which has recently been reduced to less than a minute. In other words, a color analysis now takes no longer than is required for the measurement of some of the simplest of physical properties.

Commercial development is being carried on by the General Electric Company, to whom the patent rights have been assigned by Professor Hardy.

## FIELDS OF APPLICATION

The importance of the new color analyzer lies in its value to industry in nearly every branch of which control of the color of its products is necessary. Accurate measurement of colors is the first concern of manufacturers of fabrics, particularly in the delicate shades which often deceive the eye. Color control is also of basic importance in the making of inks, paints, dyes, and paper. In fact, there is scarcely an industry without a color problem.

Lubricating oils are graded almost entirely on the basis of color. In the same way, small differences in color mean thousands of dollars in the sales of cottonseed oil. It is an established custom on the New York Produce Exchange for the buyer to demand an oil of amber hue. An oil which is slightly red sells for several cents per gallon less than the "prime" oil, although the difference in color may be so small that it would be scarcely noticed by the ordinary purchaser.

The color of a product usually is neither the most important nor least important property; it is simply one of the properties which many manufacturers attempt to control in order to please either the retailer or the consumer. A concern whose chief product is canned peaches is under no legal or moral obligation to maintain a color standard for this commodity, but from the standpoint of the consumer it is desirable that the peaches from one can have the same color as those from another since the contents of the two cans may be placed in the same dish. Some packing companies, therefore, cater to an exacting clientele by establishing and maintaining a definite set of color standards.

The desirability of a product of uniform color applies equally well in manufacturing such things as soap, lard, flour, butter, oleomargarine, cheese, sugar, syrup, chocolate, glass, automobiles, tile, brick, roofing ma-

terials, carpets, rope, hardware, paper, leather, cement, linoleum, textiles, cosmetics, and many other products.

Even educational institutions are concerned with color questions, the Massachusetts Institute of Technology recently having taken steps to standardize the official "cardinal and gray," so that the Institute colors may hereafter be reproduced exactly and forever.

One of the most important fields of usefulness for the recording spectrophotometer is expected to be in the cataloging of the curves of different dyes, so that new colors with predetermined characteristics can be obtained at any time by the proper mixture of standard dyes already at hand.

Since the development of the instrument, there has not elapsed sufficient time to allow of a test of its applicability to all of the industries in which it is expected to be of service, but a sufficient number of tests have been made to indicate that the instrument will be of use in many different kinds of work.

---

DR. WHITNEY.—Dr. W. R. Whitney, Director of the Research Laboratories of the General Electric Co. at Schenectady, N. Y., U. S. A., for the past twenty-eight years, has been elected a vice-president of the company.

---

### INCREASE IN SIZE OF THIS JOURNAL

With this issue, marking the beginning of Volume XII, the size of RADIOLOGY is increased by the addition of an eight-page form. This has been necessitated by the fact that a wealth of material awaits publication, representing the papers read at the Annual Meetings of the Society, and contributions. The essayists have been without exception patient in the matter of awaiting the publication of their papers, and the Edi-



tor is glad to state that the increased number of pages each month will enable him to add at least one paper to each issue. The Business Office, also, reports increased advertising, so that RADIOLOGY may justly pride itself on healthy growth in its journalistic career.

two references to the literature, has been added.

The size of the work and the number of illustrations have remained the same as in the first edition. The external make-up of the book is of the same excellent quality as before.

F. HAENISCH.

Hamburg, Germany.

## BOOK REVIEWS

LEHRBUCH DER RONTGENDIAGNOSTIK, MIT BESONDERER BERÜCKSICHTIGUNG DER CHIRURGIE. By H. R. SCHINZ, with the collaboration of W. BAENSCH and E. FRIEDL. Contributions by A. HOLZ, O. JUNGLING, E. LIEBMANN, E. LOOSER, and K. ULRICH. With an introduction by P. CLAIRMONT and E. PAYR. With 1,722 illustrations in the text (some colored) and five photographic plates. Second, emendated edition. Publisher, Georg Thieme, Leipzig, 1928. Pages XVIII and 1,331. Price, 90 marks (\$21.40); bound, 98 marks (\$23.30).

When, in my review of the first edition of this excellent work, which appeared in the April number of RADIOLOGY, I expressed the opinion that the book would find its way into the library of every roentgenologic department, I did not err greatly, as it now appears. After an unusually short time, the first edition (which was large) became exhausted, and after scarcely five months we already have the second edition before us.

On turning its pages, we find a few slight changes, needed additions, etc., especially in the chapter on the bones, and in the article dealing with corpora libera. The classification of bone tumors has been changed somewhat, while the discussion of sarcomas has been entirely rewritten.

As to the illustrations, the reproduction of a plasmocytoma is new. Illustrations 1197 and 1176 have been improved. In Plate III, the lobus venæ azygos, with the

HANDBUCH DER RONTGENTHERAPIE. Bearbeitet von PROF. DR. K. AMERSBACH, Prag; PRIVATDOZENT DR. W. GRAVINGHOFF, Münster-i.-W.; PROF. DR. FRANZ M. GROEDEL, Bad-Nauheim; PROF. DR. R. HABERMANN, Hamburg; PROF. DR. H. HOLFELDER, Frankfurt-i.-M.; PRIVATDOZENT DR. K. KADING, Münster-i.-W.-Delmenhorst; PROF. DR. M. KOERNICKE, Bonn; MEDIZINALRAT DR. G. KOHLMANN, Oldenburg; GEH. MEDIZINALRAT PROF. P. KRAUSE, Münster-i.-W.; DR. C. KRUCHEN, Münster-i.-W.; DR. H. LOSSEN, Darmstadt; PROF. DR. R. MARTIUS, Göttingen; PROF. DR. P. PRYM, Bonn; DR. K. SCHMIDHUBER, Bonn; PROF. DR. H. SCHREUS, Düsseldorf; PROF. DR. W. STOCK, Tübingen; PROF. DR. M. WEISER, Dresden-Bogota. Herausgegeben von GEH. MEDIZINALRAT PROF. DR. MED. PAUL KRAUSE, Direktor der medizinischen Universitätsklinik in Münster-i.-W. (Handbuch der gesamten medizinischen Anwendungen der Elektrizität einschliesslich der Röntgenlehre herausgegeben von H. BORUTTAU und L. MANN.) Band III, 2 Teil (in 3 Teilbänden). III Teilband, mit 273 Abbildungen. Published by Georg Thieme, Leipzig, 1928. Price 56 marks (paper), 59 marks (cloth).

This rather pretentious work of 732 pages covers the entire subject of roentgenotherapy. The subject matter is comprehensively divided under numerous heads and systematically indexed and cross-indexed.

Roentgenotherapy in Ophthalmology; in Internal Diseases; in Peripheral and Cen-



tral Nervous System; of the Circulatory System; of the Endocrine Glands; of the Respiratory Organs; of the Hematopoietic Organs; the Digestive Tract; the Genito-urinary Organs; the Joints (Exclusive of Tuberculosis); of Surgical Diseases (Including Benign and Malignant Tumors); Surgical Tuberculosis; Accidents and Injuries in Roentgenotherapy and Their Correct Evaluation—these are the titles of some of the chapters.

Dr. Hans Holfelder, under the head of "Roentgenotherapy of Surgical Diseases," states that "*it is a widespread error that melanosa sarcoma is never benefited by roentgenotherapy*" (italics mine). He urges more thorough roentgenization and illustrates a five-year "rezedivfrei" case. Several remarkably successful cases of treated bone sarcoma are illustrated and dwelt upon at considerable length.

Illustrations to the number of 273 are introduced in the text, along with histories, to help elucidate the authors' cases.

Paper and press work are excellent. This is a valuable work for those who want to keep up with what the German roentgenologists are doing and advocating.

I. S. T.

A TEXT-BOOK OF ACTINOTHERAPY. By D. D. ROSEWARNE, M.R.C.S. (Eng.), L.R.C.P. (Lond.), Late Honorary Actinotherapist and Assistant Physician, City of London and East London Dispensary, etc. C. V. Mosby Co., St. Louis, 1928. Pages 237. Price \$4.00.

This is a brief and practical presentation of the essential principles of ultra-violet radiation. The subject is arranged in three parts, as follows: (1) The Physical and Chemical Action of Light; (2) The Bio-

logical Action of Light; (3) Clinical Procedure.

The conservative attitude of the author is reflected in the following statements: "Actinotherapy is a valuable adjuvant treatment; it is specific in rickets and a most powerful agency for restoration in most forms of debility. The fact that these conditions constitute a high proportion of general ill-health, and that the welfare of humanity is largely bound up with their correction, should not be allowed to obscure the other fact, that in many virulent diseases actinotherapy is quite inoperative, and may even be harmful. Its scope may yet be considerably enlarged, but in the treatment of a very great number of diseases it can never replace other medical and surgical methods."

This book is intended as an elementary guide for students and physicians, and as such it should be popular.

DIAGNOSTIC ET THERAPEUTIQUE PAR LE LIPIODOL. By J. A. SICARD and J. FORESTIER. Masson et Cie, Paris, 1928. Pages 370. Price 50 francs.

In 1923 the authors first published the extraordinary results obtained by the use of iodized oil as a contrast medium in the spinal canal and lungs. The importance of the methods was at once recognized and the radiographic visualization of body cavities by means of iodized oils is now universally employed.

This excellent monograph first discusses the constitution and properties of lipiodol and its absorption in and elimination from the body. It then sets forth the technical methods employed in its injection in the spinal canal, the lungs, the genito-urinary tract, abscesses and fistulae, blood vessels, intranasal sinuses, lacrimal ducts, bone cav-

ities, and digestive tract, and gives the results obtained.

The numerous illustrations show the great radiographic contrast obtained and give ample proof of the diagnostic value of the applications of the method.

Written in simple French, clear in expression, concise in statement, and logically arranged, the book is readable, while its arrangement under numerous subdivisions and headings makes it a valuable and ready reference text.

Perhaps the only adverse criticism that may be offered refers to the emphasis placed on the extraordinary virtue of the commercial product "Lipiodol." It does seem unnecessary to extol this particular form of iodized oil.

A supplementary section is devoted to the therapeutic applications of lipiodol.

This is a book of 370 pages, with complete bibliography and 49 large size and

clear illustrations, and—wonder of wonders—it sells for 50 francs, or \$2.00!

I. SETH HIRSCH, M.D.

DIATHERMY: ITS PRODUCTION AND USES IN MEDICINE AND SURGERY. By ELKIN P. CUMBERBATCH, M.A., B.M. (Oxon), D.M.R.E. (Camb.), M.R.C.P., Medical Officer-in-Charge, Electrical Department, St. Bartholomew's Hospital, etc. Second Edition. C. V. Mosby Co., St. Louis, 1928. Pages 332. Price \$7.00.

This is a brief and elementary presentation of the principles and application of diathermy. The second edition of this book has been enlarged and the section concerning the surgical uses of diathermy has been largely rewritten. A short bibliography is now included.

## ABSTRACTS OF CURRENT LITERATURE

### INDEX TO ABSTRACTS IN THIS ISSUE

ADLER, A. Anemic Hemolytic Splenomegaly—A Group of Symptoms Similar to Hemolytic Icterus .....	86
BAENSCH, W., and FINSTERBUSCH, R. Clinical Experiences with Therapeutic Use of Cathode Rays .....	86
BEASLEY, I. E. (with GLASSER, OTTO).....	86
BEER, EDWIN. Physical Agents in Treatment of Bladder Tumors .....	84
BEHNKEN, H., and JAEGER, R. German Unit of Roentgen-ray Dose.....	89
BICKENBACH, W. (with GREBE, L.).....	90
CRAMER, H. Studies of Biological Effect of Roentgen Rays .....	90
ELLER, JOSEPH J. Supersoft Roentgen Rays (2 A.) in Dermatology.....	84
FINSTERBUSCH, R. (with BAENSCH, W.).....	86
GLASSER, OTTO, and BEASLEY, I. E. Dosimetry of "Borderline Rays" with Photometer of Wintz and Rump.....	86
GRAHAM, ROSCOE R. Carcinoma of Stomach.....	91

GREBE, ARNOLD. New Method to Increase Value of Cholecystography for Differential Diagnosis .....	5
GREBE, L., and BICKENBACH, W. Relation between R-unit and Sabouraud Unit.....	90
HALL, E. W. (with HICKEY, P. M.).....	87
HANKS, MARY E. Roentgen Ray as Remedy in Benign Gynecologic Disease: Summary of Eleven Years' Observation .....	90
HAUSSER, K. W., and SCHLECHTER, E. Skin Erythema Dose as Biological Unit of Radiation Effect .....	89
HICKEY, P. M., and HALL, E. W. Report Analyzing Results of Questionnaire Sent Out to Radiologists, under Direction of Sex Committee of National Research Council.....	87
HINES, L. M. Frequency of Tuberculous Involvement of Right Lung as Determined by Physical Examination and X-ray Findings....	84
HOFFNER, KARL. Cure of Roentgen-ray Ulcers by Subaqueous Heat Douches.....	92
INGBER, E. On Radium Sensitivity of Actinomyces .....	88
JAEGER, R. (with BEHNKEN, H.).....	89
KACURA, T. (with NASLEDOW, D.).....	88

KNIGHT, R. W. Relation of Sinus Infections to Respiratory Disease .....	91
LENART, ERNST. Regarding Favorable Effect of Roentgen Rays in Obstipation.....	91
MCGUFFIN, W. H. Radiological Study of Appendix .....	88
MAGNER, W. Chronic Cholecystitis.....	85
NASLEDOW, D., and KACURA, T. Influence of Electrical Form of Discharge upon Energy Distribution within Continuous Roentgen Spectrum .....	88
BERGUGGENBERGER, VIKTOR (with SAUTER, FRITZ)	89
PIRIE, A. HOWARD. Rodent Ulcer.....	89
RUMP, W. Energy Measurements on Roentgen Rays .....	87
SAUTER, FRITZ, and BERGUGGENBERGER, VIKTOR. Roentgen Rays and Electric Conductivity....	89
SCHAEFER, S. W. Destruction and Healing in Pulmonary Tuberculosis as Shown in Serial X-ray Films .....	89
SCHLECHTER, E. (with HAUSER, K. W.).....	89
SCHULTZE, GUNTER K. F. Roentgen-ray Dose in Carcinoma of Uterus, Expressed in Roentgen Units, Following Ionization Measurements in Vagina.....	85
STARR, F. N. G. Hyperkeratosis of Esophagus..	90
THEDERING, FRANZ. On Dosage of Ultra-violet Light in Skin Diseases.....	92
THOMASON, T. H. Ollier's Disease: Report of Case .....	88

**Supersoft Roentgen Rays (2 A.) in Dermatology.** Joseph J. Eller. *Am. Jour. Roentgenol. and Rad. Ther.*, November, 1927, XVIII, 433.

"Supersoft" roentgen rays of two Ångström units, otherwise known as Grenz or oversoft rays, have been found to have a definite though limited field of usefulness in the armamentarium of the dermatologist. The one disease in which these rays, as generated by 8 K.V., using a Müller tube (a hot cathode tube with a Lindemann glass window), are definitely superior to the commonly used shorter wave length roentgen rays, is epithelioma of the eyelid. Other skin conditions also successfully treated by supersoft rays are: dermatophytosis, Duhring's disease, lichen planus hypertrophicus, perlèche, tinea capitis, verruca vulgaris, small keloids, neurodermatitis, and sycosis barbæ. Considering 8 K.V., 8 ma., 6 cm. distance, for 3 minutes through a Müller tube, as an erythema dose, the treatment ordinarily consisted of one to

two such doses at two- to four-week intervals. While the author has seen no atrophy or telangiectasia following three units of exposure, he warns that these rays are not without the dangers of such possible sequelæ, although they are probably much less frequent than in the usual roentgen therapy field.

J. E. HABBE, M.D.

**The Frequency of a Tuberculous Involvement of the Right Lung as Determined by Physical Examination and X-ray Findings.** L. M. Hines. *Va. Med. Monthly*, January, 1928, LIV, 649.

An interesting study of 850 patients, with respect to the relative frequency of right or left lung involvement, is reported from the Blue Ridge Sanatorium, Virginia. By combining the physical and X-ray findings, it was found that the right lung showed the oldest and most extensive lesions in 512 cases, or 60.2 per cent, while the left lung was involved in only 338 cases, or 39.8 per cent. A further significant finding was the frequency with which cavities were shown by the X-ray which had not previously been discovered by physical examination. Only 50 per cent of the cavities shown by the X-ray had given physical evidences of their presence.

W. WARNER WATKINS, M.D.

**Physical Agents in the Treatment of Bladder Tumors.** Edwin Beer. *Am. Jour. Surg.*, February, 1928, IV, 113.

The author first describes the treatment of benign papillomata. In these conditions he employs the high frequency current, using both monopolar and bipolar methods. He describes the special technic necessary in this treatment and some of the dangers encountered. The first class of cases are all treated through the cystoscope and necessarily these cases must be carefully picked before attempting treatment. Of 158 cases so treated, 89 have been found free from local recurrence. There have been 23 definite recurrences, 15 of which are carcinomatous. There were also 46 uncontrolled cases, many of which have been lost sight of.

The next series of benign papillomata were treated by non-cystoscopic methods. In these cases the author used a Paquelin cautery, electric cautery and high frequency current. In addition to this, he has cleared out the entire bladder with alcohol and soaked it for five minutes in an attempt to destroy any cells which might possibly be implanted. Out of 33 such cases, there are 17 (60 per cent) which are apparently well. There was a mortality of 12 per cent, while recurrences occurred in 15 per cent of the cases.

In a series of 28 cases of papillary carcinoma treated by open operation there was an operative mortality of 14 per cent. There were 25 per cent recurrences and 15 cases (60 per cent) are apparently well. In another series of 37 cases of infiltrating carcinoma treated by resection, with or without ureteral transplantation, there was an operative mortality of 21 per cent; 43 per cent recurrences, and 35 per cent of the patients apparently well. The majority of these, however, were less than five-year cures.

In another series of cases radium has been used. In the first group 16 cases were treated with radium seeds introduced through the cystoscope. There was no mortality in these cases. Eight cases were apparently cured and eight showed recurrence, while in some no effect could be noted. In another group there were 31 cases, in all of which the radium seeds were introduced into the tumor through a suprapubic cystostomy. In this group there was a mortality of 33 per cent. Of patients who survived operation, 30 per cent were controlled and are apparently well. Of this latter group it must be remembered that these are otherwise hopeless cases, as all cases which were considered operable were resected.

In the author's experience the use of deep roentgen ray has not been satisfactory and he does not place much value on it.

H. P. DOUB, M.D.

**The Roentgen-ray Dose in Carcinoma of the Uterus, Expressed in Roentgen Units, Following Ionization Measurements in the**

**Vagina. Günter K. F. Schultze. *Strahlentherapie*, 1928, XXVIII, 524.**

The author presents in this paper the results of ionization measurements undertaken on patients in order to get quantitative data regarding back-scattering and distribution of X-ray intensity in tissue. When using 170 K.V., 0.8 Cu. plus 0.5 Al., 30 cm. distance,  $10 \times 15$  cm. field of entry over the pelvis, the back-scattering amounted to 30 per cent in the abdominal field, 29 per cent in the dorsal field, and 34 per cent in the lateral field, the latter being measured with a different chamber. Measurements in the water phantom and also on patients with the ionization chamber in the vagina led to the conclusion that each half of the pelvis has to be irradiated with 70 to 75 per cent of the S.U.D. This will bring up the total dose to an even 100 per cent, with a variation of from 5 per cent to 10 per cent. The isodose curves approached more closely those published by Dessauer and his co-workers than the isodoses of Holfelder. The average dose administered to the carcinoma amounted to from 600 to 800 R; this should be regarded as the maximum dose.

E. A. POHLE, M.D.

**Chronic Cholecystitis. W. Magner. *Can. Med. Assn. Jour.*, February, 1928, XVIII, 155.**

Chronic cholecystitis is a common disease and difficult of diagnosis. All measures should be used in arriving at a diagnosis, namely, clinical, radiological, and chemical. The indirect evidence furnished by radiology is of great importance in the elimination of such conditions as peptic ulcer, cancer, duodenal ileus, atonic or spastic colon. The direct radiological evidence of chronic cholecystitis is less reliable, in the opinion of the author. The Graham method gives much information, but is open to many sources of error, such as variations in digestion of the capsules, absorption of the dye, ability of the liver cells to excrete, patency of the cystic duct, non-distention of the gall bladder with bile at the time, concentrating power of the gall bladder, and



non-emptying of the gall bladder prior to the radiographic exposure. Further, a considerably damaged gall bladder may be capable of showing a fairly normal shadow.

The most significant sign demonstrable by physical examination in cases of chronic cholecystitis is the presence of definite tenderness over the gall-bladder region, best elicited in the erect position. The abstractor would like to emphasize this as of great importance. It is one of the findings on which he places great stress, elicited as it is by the upright fluoroscopic examination, when the exact position of the gall bladder is determined by the position of the visualized duodenum.

L. J. CARTER, M.D.

**Dosimetry of "Borderline Rays" with the Photometer of Wintz and Rump.** Otto Glasser and I. E. Beasley. *Strahlentherapie*, 1928, XXVIII, 611.

Wintz and Rump have constructed a dosimeter which is based on the photometric principle. It can be used for the dosage of X-rays of long wave length (1-2 Å.) if the black paper on the fluorescent screen is replaced by goldbeaters' skin. The latter does not absorb this radiation to any appreciable extent. A detailed account of the experiments is to be published in the near future.

E. A. POHLE, M.D.

**Anemic Hemolytic Splenomegaly—a Group of Symptoms Similar to Hemolytic Icterus.** A. Adler. *München. Med. Wchnschr.*, December, 1927, LXXIV, Nr. 51, p. 2167.

Hemolytic icterus is a constitutional anomaly, and hereditary. The basic characteristic of the disease is a diminished osmotic resistance of the erythrocytes, which also often are spherical in shape. Symptoms, particularly chronic anemia, splenomegaly, and icterus, are but secondary and due to the anomaly of the erythrocytes. This paper describes four cases which represented clinically the picture of a hemolytic icterus but entirely lacked the diminished osmotic resistance of the erythro-

cytes. For this reason they are separated from the group of hemolytic icterus and described under the particular title. In the author's opinion there is no such clinical entity as acquired hemolytic icterus, since a careful clinical investigation of those cases brings out a great variety of diseases which are able to secondarily bring on similar symptoms. He names, for instance, primary and secondary anemia; toxic and syphilitic forms of icterus with anemia, particularly in mushroom and chloroform poisoning; icterus in patients infected with malaria and going through a pregnancy; septic infection with secondary anemia and icterus; splenomegalic cirrhosis with secondary passive congestion; cardiac diseases; Banti's disease. In most of these cases the icterus is of the hepatic type.

HANS A. JARRE, M.D.

**Clinical Experiences with the Therapeutic Use of Cathode Rays.** W. Baensch and R. Finsterbusch. *München. Med. Wchnschr.*, December, 1927, LXXIV, Nr. 51, p. 2171.

The German "Phönixwerke" constructed a cathode ray tube similar to the one Dr. Coolidge constructed in this country. Experiments with this tube have been conducted in the surgical department of the University Hospital at Leipzig, where the biological influences of the ray were studied on animals and human beings. The research work is based upon former experimentation, published particularly since 1914 by a number of workers. As to technic the authors used 3 milliamperes, 95 kilovolts, 5 centimeters distance between the window of the tube and the irradiated surface. Under such conditions animals easily withstood a treatment of 3 minutes. In man, however, this dose caused slight combustion, so that in time the authors reduced their dose, usually from 10 to 30 seconds. This dose could be repeated within from eight days to two weeks. With the tube so closely approaching the irradiated surface it was necessary to ground one pole of the high tension transformer. The biological experiment entirely confirmed the report by Dr. Coolidge and his co-workers.

In the Clinic a number of patients with dif-



ferent types of lupus, localized psoriatic lesions, and epitheliomata, particularly of the *ulcus rodens* type, were successfully treated. All these lesions, as is well known, are quite frequently highly resistant to X-rays and inclined to recurrences. During an observation of one-half year no recurrences were observed. Following irradiation with cathode rays an aggravation of symptoms always preceded the final improvement. The experiment will be continued.

The authors admonish particular care to be exercised in experimentation with cathode rays, since the energies applied are extremely high. All precautions should be observed, that severe damage such as occurred in the early era of X-rays may be prevented.

(*Abstractor's Note*):—Two points particularly interested us: Combustive changes, as reported by the authors, coincide closely with typical descriptions of X-ray sores. We wonder if it may not actually be the influence of electrons eliminated in the X-ray irradiated tissue which is causing biological effect. Secondly, the paper points out in several instances that entirely unaffected cell groups remained enclosed within severely damaged tissue. These groups tended toward regeneration. It would seem quite possible that the grid supporting the window of the tube is responsible for these islands of unaffected tissue.

HANS A. JARRE, M.D.

**A Report Analyzing the Results of the Questionnaire Sent Out to Radiologists, under the Direction of the Sex Committee of the National Research Council.** P. M. Hickey and E. W. Hall. *Am. Jour. Roentgenol. and Rad. Ther.*, November, 1927, XVIII, 458.

In response to the questionnaire sent out to and answered in part or whole by 377 radiologists, some interesting statistics were gleaned and a few conclusions drawn. In answer to the questions in Form A regarding changes in the mother, in 79 cases exposed before or during pregnancy, no deleterious effects were noted from diagnostic exposures, and no decrease in libido resulted from superficial therapeutic exposures, but such usually did occur

following deep therapy exposures of pelvic conditions.

In answer to the questions in Form B regarding changes in the fetus, 76 pregnant mothers received diagnostic exposures without any subsequent abnormalities in the fetus which might be attributed to the effects of the radiation. In 13 cases receiving radiation for therapeutic purposes, one case of fibroid uterus receiving treatments at about the third month of pregnancy delivered a still-born child at full term.

Answers to Form C, which dealt with changes in the sex life of the radiologist, of 377 replies, 311 (82 per cent) reported no change, 27 (7.2 per cent) reported increased libido, and 30 (7.9 per cent) reported decreased libido. In the families of radiologists having children the average number was 2.2, with an average of only 1.74 children born to the group of radiologists sending in reports. The average age of the radiologist-father was 43.7 years, whereas in another table of statistics of physicians and surgeons of ages 40-44 the average number of children was 3. In respect to the question of abnormal children an interesting fact was brought to light when it was noted that two Mongolian idiots had been born to fathers prior to their engaging in radiology, while only one Mongolian idiot had been born to the group following the taking up of radiological practice. Fourteen radiologists (3.7 per cent) voluntarily reported the presence of roentgen dermatitis, but none of these individuals showed partial or complete sterility. The reports on means of protection employed against the rays were so indefinite as to warrant no conclusions.

J. E. HABBE, M.D.

**Energy Measurements on Roentgen Rays.** W. Rump. *Ztschr. f. Physik*, 1927, XLIII, 3-4, 254, and *Ztschr. f. Physik*, 1927, XLIV, 4-5, 396.

The author uses a calorimeter of special construction to determine the total energy of X-rays in absolute units. This total energy was measured in comparison to voltages from

43 to 150 K.V. at the tube. The total energy was found to be proportional to the square of the voltage. A comparison of the total energy of the X-rays with that of the cathode rays showed the efficiency of this energy transformation to vary from 0.5 to 1.6 per cent between 43 and 150 K.V.; this is a higher efficiency than previously found. By comparing the energy of the rays with the ionizing effect, Rump finds that the energy necessary to produce one pair of ions is 33 volts for hard filtered rays. Probably this value is constant for average wave lengths between 0.43 and 0.12 Å.U.

To be appreciated, this valuable contribution to the problem of the determination of the energy of X-rays must be read in the original.

OTTO GLASSER, PH.D.

**On the Radium Sensitivity of Actinomyces.** E. Ingber. *Strahlentherapie*, 1928, XXVIII, 581.

In order to study the sensitivity of *Actinomyces bovis* to radiation, pure cultures were exposed to radium in a glass jar. Technic: 25 mg. of mesothorium inclosed in a glass tube and filtered by silver, brass, and copper of a total thickness of 1.5 mm., 3 cm. between cultures and radium. The culture was examined every day for eighteen days, both microscopically and by making new cultures up to the third generation. Even the total dose of 10575 mgh. did not kill the fungi. There was a temporary paralyzing effect which disappeared after the removal of the source of radiation, in the next generation.

E. A. POHLE, M.D.

**A Radiological Study of the Appendix.** W. H. McGuffin. *Can. Med. Assn. Jour.*, November, 1927, XVII, 1329.

The appendix is visualized most frequently between the twelfth and twenty-fourth hour after an opaque meal. It fills and empties many times daily, due largely to antiperistalsis in the proximal colon and to peristalsis in the appendix itself. The signs of appendiceal disease are: (1) Tenderness on palpation; (2)

Spasmodic incisura of the base of the cecum; (3) Displacement downward, with more or less fixation, of the proximal third of the transverse colon; (4) Displacement of the pelvic colon to the right, with fixation in the right iliac area.

L. J. CARTER, M.D.

**Ollier's Disease: Report of a Case.** T. H. Thomason. *Texas St. Jour. Med.*, March, 1928, XXIII, 721.

This term is used to designate cartilaginous dystrophy, with or without cartilaginous tumor or exostosis formation, showing an asymmetrical involvement of the body as the outstanding feature. A case is reported, with a number of radiographs, showing typical asymmetry and extensive distribution. In the tibia, upper femur, and humerus the involvement suggests a growth of central origin, arising near the epiphysis, expanding and thinning the cortex. In other areas there was a longitudinal striation arising in the cortex near the epiphysis and extending up the shaft. Cole, in 1926, reported fourteen cases, and added another.

W. WARNER WATKINS, M.D.

**Influence of the Electrical Form of Discharge upon the Energy Distribution within the Continuous Roentgen Spectrum.** D. Nasledow and T. Kacura. *Ztschr. f. Physik*, 1927, XLIV, 3, 216.

The authors studied the energy distribution of X-ray spectra from a tube which was excited by three different types of apparatus. They used alternately the "Stabilivolt" and a similar valve tube apparatus, which furnish very nearly a high tension direct current, and also the "Hartstrahl" apparatus, which gives a somewhat unrectified alternating current. From studies on these spectra as well as from ionization measurements with a small ionization chamber the authors conclude that the radiation intensity furnished with the valve tube machines is about one and one-half times higher than that of the "Hartstrahl" apparatus.

tus, if both are operated under identical working conditions. The effective wave lengths obtained under similar conditions were also compared and were found to be considerably shorter for the valve tube machines than for the "Hartstrahl" apparatus.

OTTO GLASSER, PH.D.

**Destruction and Healing in Pulmonary Tuberculosis as Shown in Serial X-ray Films.** S. W. Schaefer. *Colo. Med.*, March, 1928, XXV, 85.

By the use of serial radiographs, a great deal can be learned about the development of tuberculous lesions in the lungs, how they progress, or how they heal. This paper shows a number of series illustrating the changing character of such lesions, and concludes that (1) tuberculous lesions in the lungs may heal by resolution as well as by fibrosis and calcification; (2) massive pulmonary lesions may form with comparative rapidity and not be found even on expert physical examination; (3) there is a great advantage to the physician and to the patient in serial radiographs.

W. WARNER WATKINS, M.D.

**Rodent Ulcer.** A. Howard Pirie. *Can. Med. Assn. Jour.*, November, 1927, XVII, 1326.

The author reports a series of 34 patients, who responded to queries regarding the results of treatment. Thirty-two were healed. The technic of X-ray treatment consists of but one treatment to an ulcer. The dose is four times an epilation dose. No filter is used.

L. J. CARTER, M.D.

**The German Unit of the Roentgen-ray Dose.** H. Behnken and R. Jaeger. *Ztschr. f. Techn. Physik*, 1926, VII, 11, 563.

In this article from the "Physikalisch-Technische Reichsanstalt," the German "Bureau of Standards," the authors report the results of their comparison of different standard methods for the determination of the *R*-unit. They find that the units determined with an

air pressure chamber and an ordinary large air chamber agree within 1 to 2 per cent. The unit determined with a Fricke-Glasser air wall chamber does not yet satisfactorily agree with that determined by the other two methods. Probably this is due to the lack of pure materials necessary for the construction of the Fricke-Glasser chamber. Experiments in this direction are, however, continued, since an ideal air wall chamber is highly desirable to possibly connect the French Solomon *R*-unit and the German *R*-unit.

OTTO GLASSER, PH.D.

**Roentgen Rays and Electric Conductivity.** Fritz Sauter and Viktor Oberguggenberger. *Strahlentherapie*, 1928, XXVIII, 589.

The authors studied the change of the electric conductivity of metals, solutions of electrolytes, dielectrics, and gases, when exposed to roentgen rays. It appeared that there was a great change in gases and non-conductors, very little change in metals and solutions of electrolytes. They also correlate the roentgen unit with the C. G. S. system and find one *R* equals about 1,000 erg. This should be equivalent to the saturation current of one coulomb per second.

E. A. POHLE, M.D.

**The Skin Erythema Dose as Biological Unit of the Radiation Effect.** K. W. Hauser and E. Schlechter. *Strahlentherapie*, 1927, XXVII, 348.

The erythema reaction as a dose unit has been criticized by a number of investigators, and the authors undertook, therefore, experiments with ultra-violet light of different wave lengths in order to study this problem. They found that the response of the skin with an erythema depends considerably upon the wave length used. It appears, for instance, that a dose given with 3,130 Ångströms, if increased by 20 per cent, causes four times as high a reaction, while, with 2,540 Ångströms, four times the energy applied gives only twice as high an erythema. It is assumed that roentgen rays surely act as wave length 3,130 Ångströms, as borne out by the experiments of

roentgen laboratories. The erythema reaction can, therefore, be used as a biological dose unit. When using roentgen rays of long wave length (1-2 Angstroms) a new factor enters into the problem; they act as short ultra-violet rays because ten times the energy applied to the skin will lead to only four times as high a reaction. For this special part of the spectrum the erythema unit is not suitable.

E. A. POHLE, M.D.

**Hyperkeratosis of the Esophagus.** F. N. G. Starr. *Can. Med. Assn. Jour.*, January, 1928, XVIII, 22.

"Corns in the esophagus" may seem a fantastic diagnosis. Three cases are, however, reported, confirmed by microscopic examination. The X-ray showed almost complete obstruction of the esophagus, while the esophagoscope demonstrated a papillomatous mass at the site of constriction. Microscopic examination of excised section diagnosed the papilloma. These all yielded good results following a course of dilatation by bougies.

L. J. CARTER, M.D.

**The Relation between the R-unit and the Sabouraud Unit.** L. Grebe and W. Bickenbach. *Strahlentherapie*, 1927, XXVII, 358.

The authors have undertaken comparative measurements in order to study the relation between the R-unit and the Sabouraud Unit.

K.V.	Filter		Half Value Layer in Cu.	R-unit    Holzknecht	R-unit    Sabouraud
	Cu.	Al.			
175	1.0	1.0	1.3	46.9	413
170	0.5	1.0	0.9	40.1	329.8
120		3.0	.15	24.8	225.2
120		1.0	.09	29.6	261.6
120		0	.039	41.5	349.6
100		0	.039	40.7	—

<sup>1</sup>Mean values.

In deep therapy it is not safe enough to use this method in dosimetry. It must be admitted, however, that in superficial therapy the Sabouraud Unit has been employed for over twenty years and still claims its place.

E. A. POHLE, M.D.

**Studies of the Biological Effect of Roentgen Rays: On the Indirect Effect (Protein Effect) of Roentgen and Radium Rays as a Process of Digestion and Excretion of Decaying Cell Material, with Remarks Regarding the Etiology of the Roentgen and Irritation Carcinoma as "Excretion Disease" of the Skin and Mucous Membrane.** H. Cramer. *Strahlentherapie*, 1928, XXVIII, 431.

The enormous literature on the subject, with special consideration on the reticulo-endothelial system (Aschoff), is discussed at length. The author compares the stimulating effect of roentgen rays with that of non-specific protein. In patients who developed nausea following X-ray exposure, the capillaries in untreated parts of the skin were found to be dilated. This speaks for a chemical change as a causative factor and is similar to the reaction following histamin injection. Details must be looked up in the original article (51 pages).

E. A. POHLE, M.D.

**The Roentgen Ray as a Remedy in Benign Gynecologic Disease: A Summary of Eleven Years' Observation.** Mary E. Hanks. *Ill. Med. Jour.*, October, 1927, LII, 308.

The author summarizes the observation of eleven years in this paper, and as a result she has reached two definite conclusions: (1) that X-ray, in the hands of a physician with diagnostic and clinical experience, is a preferred remedy in selected cases of benign pelvic pathology, and (2) that the more deliberate low voltage technic, smaller doses over a longer period of time, is preferable to intensive X-ray therapy.

She gives five reasons for the use of her technic:

1. The pathology is favorably influenced and neighboring tissues not damaged.
2. Prostrating "roentgen sickness" does not occur.
3. No detrimental blood changes.
4. Secondary sex characteristics do not appear, probably because endocrine output of ovary is not affected.



5. Slow tissue changes, giving more time for readjustment.

Technic: Spark gap 23 cm.; distance 31 to 43 cm.; 5 milliamperes, with 5 millimeters of aluminum and sole leather as a filter; time of exposure 14 to 16 minutes, through as many portals, 8 to 13 cm. in diameter, as may be necessary to cover pathology to be treated.

*Fibromyomata* (302 cases treated).—Three well defined groups present themselves: First group, those which should be rejected for X-ray treatment; (1) Tumors associated with acute symptoms. Also those showing cystic and degenerative changes. (2) Tumors associated with large ovarian tumors. (3) Pedunculated tumors. (4) Suspicion of malignancy. (5) Submucous types, apt to be disappointing. (6) Large non-vascular tumors, slow to respond. A woman desiring children should have a myomectomy. Second group, cases which, if accepted, should be given a guarded prognosis. These cases are mainly the poor surgical risks of the first group. Third group, the hemorrhagic intramural fibroids. These should give nearly 100 per cent of satisfactory results.

*Hemorrhage of the menopause.* Twenty cases have been treated successfully.

*Small follicular ovarian cysts* have responded to treatment in 65 cases.

Sixty-nine cases of *cervicitis* responded to X-ray treatment.

Twenty-one cases of *incapacitating dysmenorrhea* have been satisfactorily treated.

*Adhesions* may be reduced.

The author concludes as follows: "I wish to urge that Time and Nature are two almost invincible allies; that in benign conditions X-ray in remedial doses, not destructive doses, reduces the pathology without injury to other tissues; that a woman's health is conserved by methods free from shock and prostration and by leaving her generative organs intact and functioning if possible; that X-ray in the hands of a physician with diagnostic and clinical experience should hold an important place in the armamentarium of the gynecologist."

C. H. DEWITT, M.D.

**Regarding a Favorable Effect of Roentgen Rays on Obstipation.** Ernst Lenart. *Strahlentherapie*, 1928, XXVIII, 598.

Thirty cases of obstipation were successfully treated with small doses of roentgen rays (deep therapy technic: 0.5 Zn. filter). Treatments were given on four successive days, a total of one to three series six weeks apart. It is suggested that this new method be given a trial.

E. A. POHLE, M.D.

**The Relation of Sinus Infections to Respiratory Disease.** R. W. Knight. *Can. Med. Assn. Jour.*, January, 1928, XVIII, 54.

The purpose of this paper is to call attention to the fact that frequently the cause of bronchopulmonary infection lies in disease of the nasal accessory sinuses.

Acute bronchitis, chronic bronchitis, bronchiectasis, and bronchial asthma are not completely explored in their etiological relations until the nasal accessory sinuses are examined by the rhinologist and the radiologist. Very frequently there is an intimate relation between chest infection and sinus disease.

L. J. CARTER, M.D.

**Carcinoma of the Stomach.** Roscoe R. Graham. *Can. Med. Assn. Jour.*, January, 1928, XVIII, 25.

The author reports results obtained in 75 cases of gastric carcinoma in which it was demonstrated that this disease need not be so universally fatal as it is usually supposed to be. The important point stressed is the necessity of recognizing the signs which indicate the transition from a benign gastric ulcer into malignancy. The signs indicating this change are, first, the fact that the distress is not relieved by measures that were formerly effective, and, second, that pain in the back becomes an additional symptom. The supervening of these changes should mean immediate surgical intervention, with resection where possible.

L. J. CARTER, M.D.



**Cure of Roentgen-ray Ulcers by Subaqueous Heat Douches.** Karl Hoffner. *Strahlentherapie*, 1928, XXVIII, 627.

Following treatment for pruritus ani, a patient developed a very painful roentgen-ray ulcer of the perineum. This was treated by daily lukewarm baths of 35° C., while water of approximately 48° C. was directed under the water toward the ulcer, by a hose separately attached. This high temperature did not cause any discomfort because the body was entirely submerged in the tub. In three weeks, the ulcer was healed. The author be-

lieves that this was due to the hyperemia induced by heating the tissue to nearly 50° C.

E. A. POHLE, M.D.

**On the Dosage of Ultra-violet Light in Skin Diseases.** Franz Thedering. *Strahlentherapie*, 1928, XXVIII, 602.

The author recommends the use of small doses in ultra-violet therapy with the mercury vapor lamp. He tries to avoid marked erythema and pigmentation. A simple test consists in exposing small areas of the skin to graded doses.

E. A. POHLE, M.D.

n  
l  
d  
t  
o